Pit and Quarry

SAND-GRAVEL-STONE
CEMENT-LIME-GYPSUM

THE IRON LEDGE COMPANY, TRUMBULL, CONN.

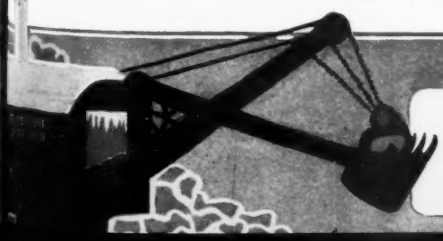
Using Adamson-Fordson Locomotive in their sand and gravel quarry.

Adamson-Fordson Locomotive

Patented

Is reducing haulage cost in 43 states and countries. Let the Adamson-Fordson serve you.

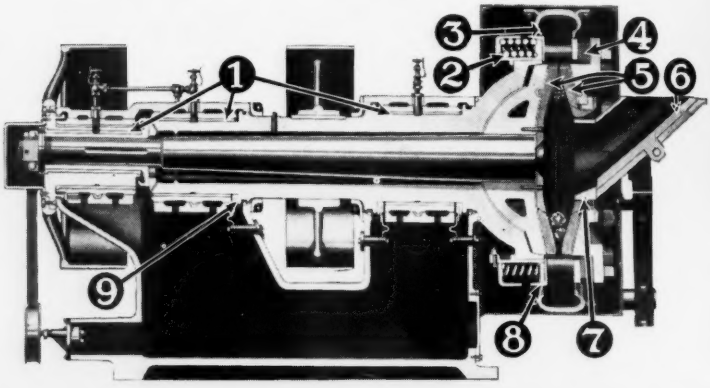
ADAMSON MOTOR COMPANY
Birmingham, Ala., U. S. A.



November 15, 1925

Circulation 7,600

NEW FEATURES



SYMONS DISC CRUSHER

1. Choice of Bronze or Babbitt Bearings.
2. Springs guarantee against breakage from non-crushable material.
3. One-piece hood liners and segment sides proportioned for minimum waste of metal.
4. Adjustment Shims for taking up wear and changing size of product.
5. Inner and Outer Discs interchangeable. Less waste.
6. Reversible bottom.
7. Manganese Feed Spout renewable end.
8. Renewable angle wearing ring.
9. Spring oil wipers—no oil leakage.

All above parts standard except springs on head which will be furnished when desired at reasonable additional cost.

The great capacity and uniform product of the disc crusher is known to all users of crushed material. Every improvement shown can be installed in any style disc crusher now in use.

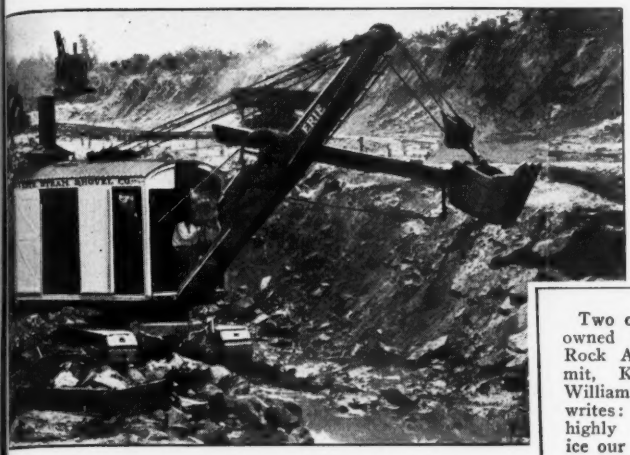
SYMONS BROTHERS CO.

ORE, ROCK AND GRAVEL CRUSHERS

RAILWAY EXCHANGE BUILDING — MILWAUKEE, WIS.

LOS ANGELES OFFICE
1462 STANLEY AVENUE
HOLLYWOOD

NEW YORK OFFICE
120 BROADWAY
NEW YORK CITY



Two of the three ERIES owned by Ohio Valley Rock Asphalt Co., Summit, Ky. Mr. Dover Williams, Vice Pres., writes: "In view of the highly satisfactory service our ERIES have given, we now use nothing but ERIES.

You've seen how ERIE owners keep on coming back for more

Anyone who gets around and talks to stone producers— and sees their quarries— knows about the *fleets* of ERIES that are owned by the most successful concerns.

There are many of these fleets of ERIES in quarries all over the country— fleets numbering from two or three ERIES up to seven or eight. Owned by well known stone producers like these listed at the left.

And concerns like these don't keep "repeating"— even on an ERIE Shovel— without being sure that it's the best buy.

The quarryman who has had ERIE Shovels is used to the ERIE's quick, snappy action that means *output*, and its sturdy strength that keeps it working *all day, every day.* He is hard to satisfy with less.

It pays to be as careful a buyer as the companies listed here.

Just a few of the many well-known quarries who have found the ERIE the best shovel "buy" — and keep coming back for more:

American Lime & Stone Co., Tyrone, Pa.
J. E. Baker Co., York, Pa.
Boggs & Burnam, Richmond, Ky.
Chemical Lime Co., Bellefonte, Pa.
Cherokee Rock Asphalt Co., Louisville, Ky.
Commonwealth Quarry Co., Summit, N. J.
Connecticut Quarries Co., New Haven, Conn.
Consolidated Sand & Stone Co., Upper Montclair N. J.
Cushing Stone Co., Schenectady, N. Y.
Rogersville Quarries, St. Thomas, Ont.
Interstate Crushed Stone Co., Springfield, N. J.
Kennedy Refractories Co., Tiffin, O.
Ky. Rock Asphalt Co., Louisville, Ky.
Sewerbutt Quarries, Paterson, N. J.
York Hill Trap Rock Co., Meriden, Conn.

ERIE STEAM SHOVEL CO.
Erie, Pa., U. S. A.

Builders of ERIE Shovels, Cranes, Ditchers, Draglines, Trench Hoes, etc.

Branch Offices: Boston, New York, Philadelphia, Pittsburgh, Atlanta, Chicago

Representatives throughout the U. S. A.

ERIE Revolving Shovels

All-Purpose Power Unit

Beaver Power unit is protected by an all-steel housing which does not interfere with the accessibility of working parts.

Sand pits and quarries using Beaver Power Units show little "lost action." Actual performance bears witness to this.

For example, Orvia Root, a New York quarry owner, says: "My Beaver Engine has enough power for every job around my quarry.

It crushes rock, does heavy grading, pulls heavy loads where a dependable engine is needed, and it is simple and economical to operate."

Let us show you where a Beaver will save money in your sand pit or quarry.

BEAVER MANUFACTURING CO.
35 TWENTY-FIFTH STREET, MILWAUKEE, WISCONSIN

FOR STEADY SERVICE

Beaver

KOEHRING

Crane Excavator

Far Greater Clutch Frictional Area!

THAT'S why the Koehring has *Finger-tip control* at the levers!

Levers work easy because the far greater contact surfaces of the double outside band, equalizing friction *clutch* makes the levers work easy!

So, you have Finger-tip control without mechanical complications to help shift levers which ought not to be hard shifting in the first place. The Koehring operator does not lose the *"feel"* of the bucket—an important factor in accuracy of operation!

Crane Capacities

No. 1—¾ cu. yd. clam-shell bucket on 40 ft. boom, standard. Lifting capacity, 10 tons at 12 ft. radius. 4 cylinder, 5"x6" gasoline engine, 1000 R.P.M.

No. 2—1 cu. yd. clam-shell bucket on 45 ft. boom, standard. Lifting capacity, 15 tons at 12 ft. radius. 4 cylinder, 5¾"x7" gasoline engine, 1000 R.P.M.

KOEHRING HEAVY DUTY

Write for Crane Bulletin No. Cr-32.

KOEHRING COMPANY

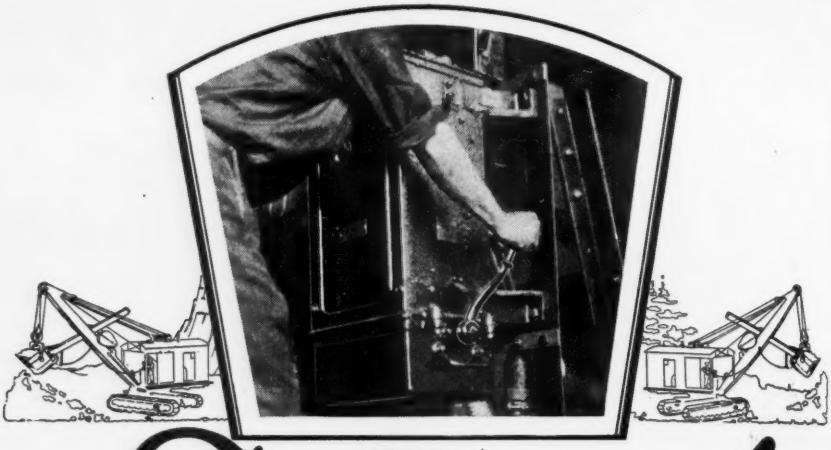
PAVERS, MIXERS—GASOLINE CRANES, DRAGLINES AND SHOVELS

MILWAUKEE, WISCONSIN

Sales Offices and Service Warehouses in principal cities

Foreign Dept., Room 1370, 50 Church St., N. Y.
Canada, Koehring Company of Canada, Ltd., 105 Front St., East, Toronto, Ontario.
Mexico, F. S. Lapum, Cinco de Mayo 21, Mexico, D. F.

A2688



So Easy!

Just Pull the Lever

The President of The Basalt Rock Company, Napa, California, says—"Our Model 32 is always ready to go—just turn on the electricity. We have never lost a minute through trouble. In other words, the shovel is what we thought it was when we purchased it; the best there is on the market—as near perfect and trouble-proof as can be made."

There is No coal to handle; no water lines to lay or freeze; the working crew is reduced; and the operating time per shift is greatly increased.

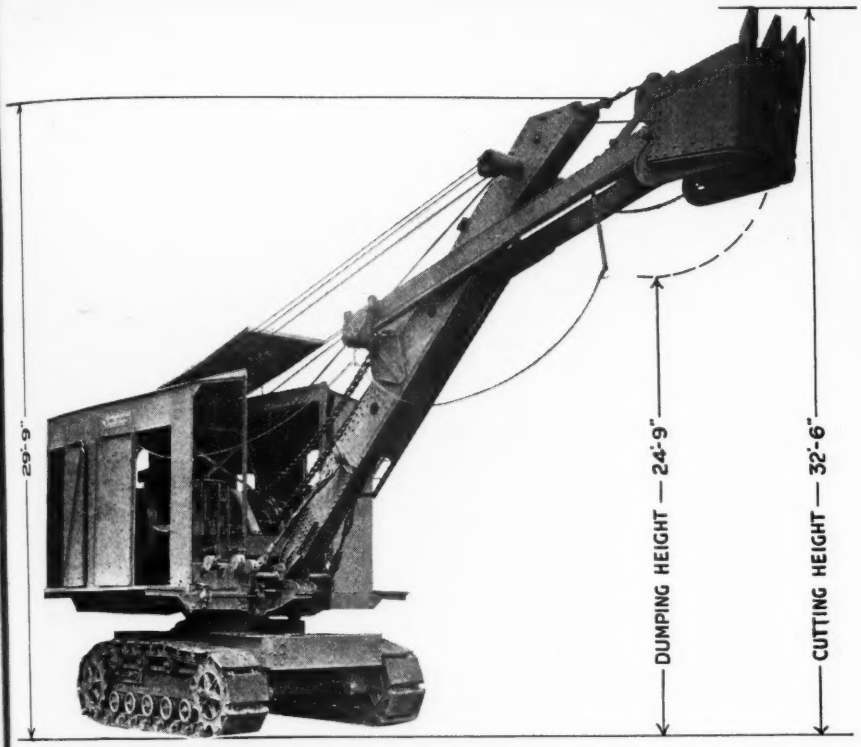
What a relief it would be to have a shovel like this at your plant.

Bulletin No. 310 will tell you more

Electric power is now available nearly everywhere and high tension lines that will eventually network the whole country are under construction. The cost of this electric power is usually remarkably low with the result that in nearly every cast the cost of operating an electric excavator is much less than a similar size steam machine.

MARION

THE MARION STEAM SHOVEL CO. MARION OHIO U.S.A.



Compare These Cutting and Dumping Heights With Any Other Gasoline Shovel

The cutting height—32½ feet—of this P&H 1¼-yard Gasoline Shovel is of particular importance not only because of the value in digging up through the top of the bank—

But is still more remarkable due to the fact that this is not mere elevating height—but actual *cutting* height. The powerful crowding motion—an exclusive P&H feature — is effective above the horizontal position of the dipper, the teeth dig up and out with the full power of the motor and fly-wheel inertia back of them.

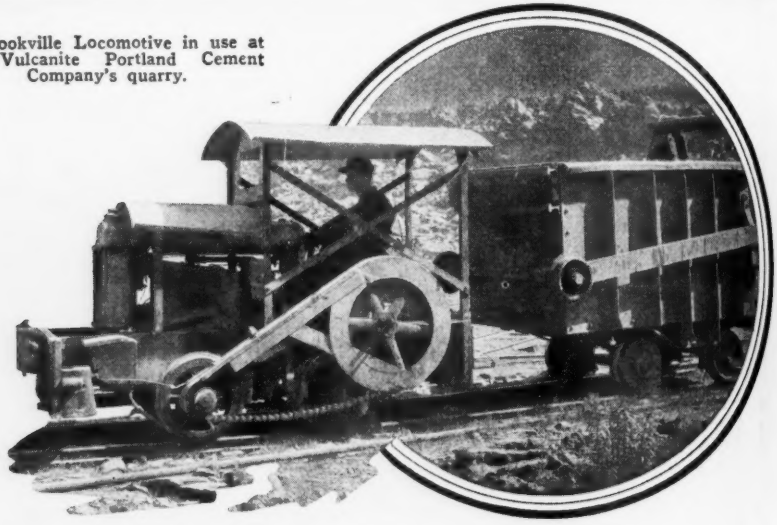
The high dumping position permits loading trucks on top of bank—saving time, labor and expense—and increasing excavating yardage.

HARNISCHFEGER CORPORATION
Successors to
PAWLING & HARNISCHFEGER CO.
Established in 1884
3851 National Ave., Milwaukee, Wis.

New York, Jacksonville, San Francisco, Minneapolis, Memphis, Philadelphia, Birmingham, Kansas City, Chicago, Los Angeles, Dallas, Pittsburgh, Detroit, Portland, Seattle

Warehouses and Service Stations: Philadelphia, Memphis, San Francisco, Los Angeles, Jacksonville, Seattle

P&H GASOLINE SHOVEL



A Brookville Locomotive in use at the Vulcanite Portland Cement Company's quarry.

You Can *Depend* Upon It

The Brookville Locomotive with the Fordson Power Unit continues to build its reputation for worth while performance.

Mr. W. R. Dunn, General Works Manager for the Vulcanite Portland Cement Company, Easton, Penna., declares that:

> *" . . . We are pleased with the Brookville Locomotive; its upkeep is exceedingly low and we can depend upon it at all times."*

In other words Brookville Locomotives can be trusted—trusted to carry on tirelessly under the most trying circumstances. Their initial cost is not high and they require much less for maintenance than might be supposed. Brookvilles are built for a long life of dependable service and are sold on actual demonstrations of merit. Let us send you additional details and prices.

BROOKVILLE TRUCK & TRACTOR COMPANY
Brookville, Pa., U. S. A.

A "MASSILLON" in the pit of Massillon Washed Gravel Co., Massillon. O.

THE MASSILLON WASHED GRAVEL CO.
MASSILLON, OHIO

September 9th, 1925.

The Russell & Company,
Massillon, Ohio.

Gentlemen:-

The "MASSILLON" Shovel which we purchased from your company in February 1925, has delivered excellent yardage and has proven its merit under most trying digging conditions.

We are particularly pleased with the power and speed of the machine and have found the construction to be sound.

You are maintaining your old name for reliable goods.

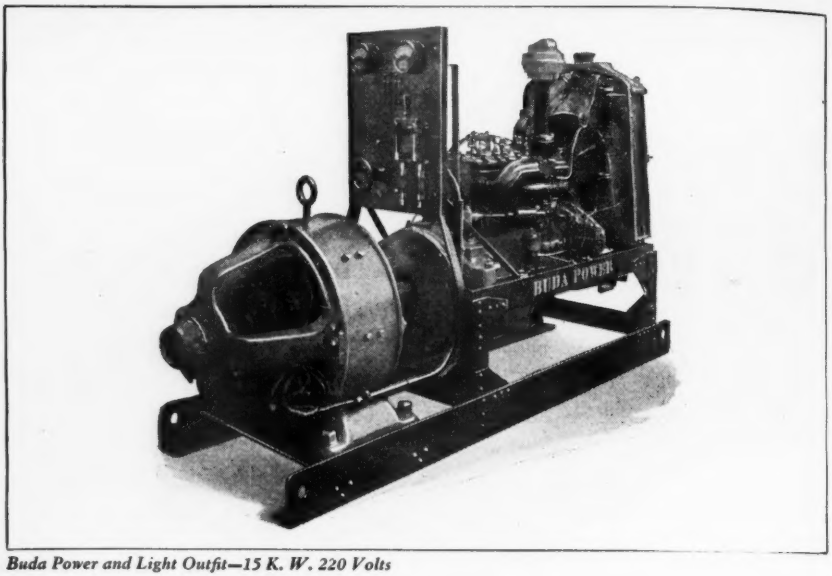
Yours truly,
The Massillon Washed Gravel Co.
C. F. Kurtz Pres.

The Experienced Digger Understands Value

THE RUSSELL & COMPANY

BUILDERS MASSILLON, OHIO

The MODERN MASSILLON
Steam — 3/4—7/8 RANGE — Shovel



Buda Power and Light Outfit—15 K. W. 220 Volts

And the Accent Is on Quality!

Three hundred days of 15 hours each—that's the first "stretch" done by this Buda lighting set. Then the operator tore it down. The ordinary engine would have needed an overhaul, but he found the parts of this Buda engine showed practically no wear. The frequency of such experiences is what makes so many enthusiasts for Buda engines.

These lighting sets, varying in capacity from 5 to 50 K.W. combine portability and low operating cost with smoothness of operation and reliability.

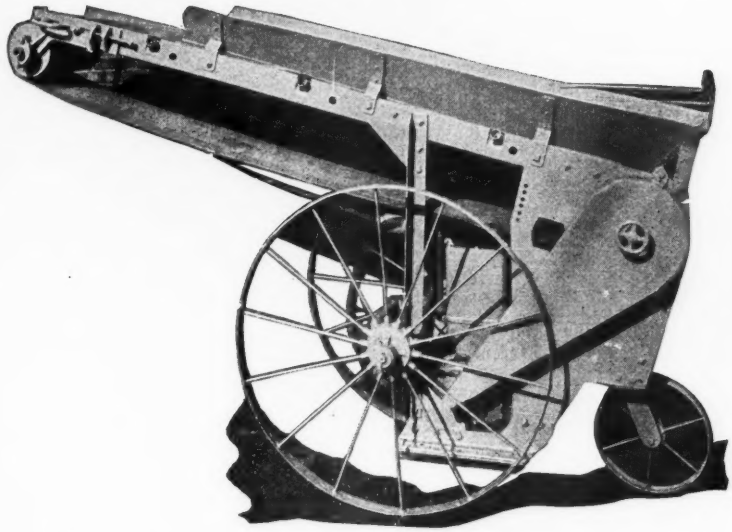
BUDA POWER is also available for drilling, hoisting, excavating and all industrial use. Write today for latest catalog and detailed specifications regarding your power equipment needs.

THE BUDA COMPANY, HARVEY CHICAGO SUBURB ILL.
ESTABLISHED 1881

Buy only genuine Buda Parts for your Buda engine

BUDA
The
ENGINE

A Sure Cost Cutter In Every Plant



The Ottumwa Box Car Loader

The trend of the times in all industry, from the government down, is cost cutting. The ideas of efficiency that have come into currency, by means of which real, practical economy may be realized, are saving business men a lot of money these days.

Saving $10 here and $10 there soon cuts your costs appreciably, and that means increased profits.

Modernize the loading end of your operations by installing an Ottumwa. It spells practical economy for you. It requires just one man to operate—one adjustment for one end of the box car and one for the other end.

Send for full information and prices today.

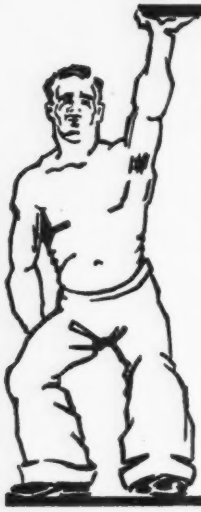
OTTUMWA BOX CAR LOADER CO.
OTTUMWA, IOWA

USE

ERA

Manganese Steel Castings

FOR RESULTS



DELAYS are costly, not to mention the repair bill. "ERA" Manganese Steel prevents this situation when parts subject to excessive wear by abrasion are cast of "ERA" Manganese Steel.

The reputation of "ERA" Manganese Steel is the result of forty years of unfailing quality and service.

HADFIELD-PENFIELD STEEL CO.
Bucyrus, Ohio

MANGANESE STEEL
ERA
THE FIRST - STILL LEADS IN QUALITY

A STANDARD QUALITY AT A STANDARD PRICE

Waukesha "Ricardo Head" Engine operating a P & H

"The MOST PERFECT MACHINE of its CLASS"

Beyond the Rockies, in Tulare, California, W. H. Wilbur, operating this Waukesha powered dredge says, "—it was run continuously for nearly two years—the motor never gave a minute's trouble—up to the present, I have spent nothing for renewal of motor parts—it is the most perfect machine of its class I have ever worked."

Waukesha "Ricardo Head" Industrial Units are available in sizes from 15 *to* 100 *H. P. Write for the bulletin entitled "Two New Waukesha Units."*

WAUKESHA MOTOR COMPANY

Waukesha, Wisconsin

New York City	Hartford	Kansas City	Denver	Tulsa	Houston
Aolian Building	*K. B. Noble Co.*	*V. L. Phillips Co.*	*Western Equip. Co.*	*C. F. Camp Co.*	*Portable Rotary Rig Co.*

Exclusive Builders of Heavy Duty Gasoline Engines for Nearly Twenty Years

BUILT FOR THE JOB

AMONG seven of the causes of motor trouble named by a prominent authority on motor matters "prolonged uncleanliness" is listed first.

It is in the very nature of things in some applications that a motor must encounter dirt, dust, fumes, dampness and all things which contribute to uncleanliness.

Westinghouse motors are built to *successfully* combat these conditions and to insure that even prolonged uncleanliness will not result in the necessity for shut-downs and lost production.

The reason for the long life and effective service of Westinghouse motors in the *Rock Products* Industry is simple—they are built for the job.

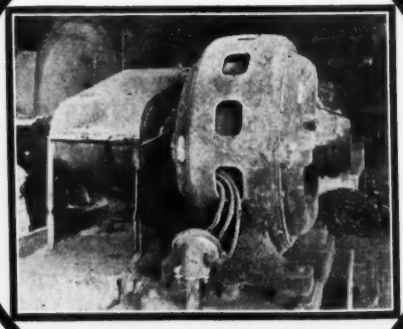
Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All the Principal Cities of
the United States and Foreign Countries

Features that render Westinghouse Motors especially suitable for use in the Rock Products Industry.

Dust Proof Bearings.

Dust and Moisture Resisting Insulation.

Effective ventilation maintaining cool motor despite most unusual conditions of dust and dirt.



250 hp. Westinghouse Motor Driving Tube Mill in Plant of Superior Portland Cement Company, Concrete, Wash.

W WESTINGHOUSE ELECTRIC

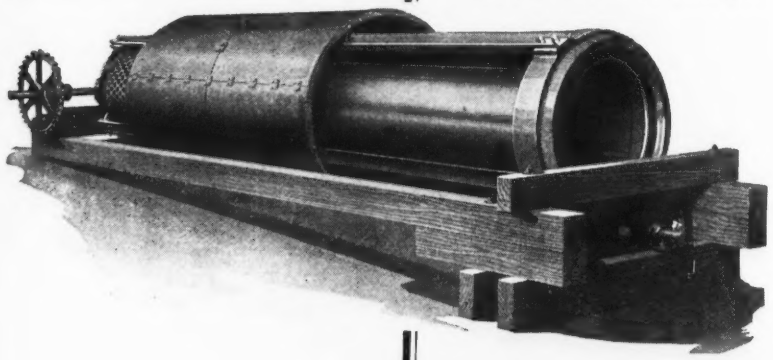
Westinghouse

K8575

TELSMITH *Scrubs* YOUR GRAVEL—

Every Telsmith Washing Screen is equipped with a scrubber, which will clean any gravel of a commercially washable character. The material is cascaded—sprayed—rubbed—soaked, until the dirt is thoroughly discouraged. Then the aggregate is graded into sand, fine rock, coarse rock—two, three or four grades, according to requirements. Both washing and sizing operations are performed in one cylinder with sand jacket. Water consumption is kept down to a minimum. Floor space and head-room are much less than required for other washing devices. The cost of the bins and transmission are both considerably reduced. Best of all, the aggregate is CLEAN beyond possibility of criticism. That's why Telsmith Washing Screens have sold like "hot cakes" during the last five years. Glad to send you Bulletin No. GP-15. No obligation whatsoever.

Telsmith Heavy-Duty Washing Screen, equipped with steel rollers, two-piece head-ring and renewable steel tracker ring.



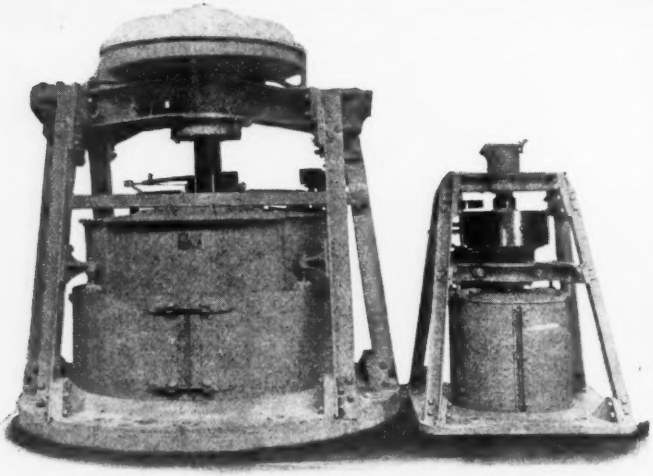
SMITH ENGINEERING WORKS

3183 Locust St., Milwaukee, Wis.

Canadian Representative, Canadian Ingersoll-Rand Co., Montreal, P. Q.

Old Colony Bldg., Chicago, Ill.
Waldo Bros. & Bond Co., Boston, Mass.
Seibert-Milburn Co., Columbus, Ohio
Borchert-Ingersoll, Inc., St. Paul, Minn.
J. W. Batholow Co., Dallas, Texas
18 East 41st Street, New York City
Beckwith Machinery Co., Pittsburgh and Cleveland
Knox Eq. & Eng. Co., Indianapolis, Ind.
Bunting Hardware Co., Kansas City, Mo.
Interstate Eng. & S. Co. Omaha, Neb.

PULVERIZERS



Bradley Hercules Mill No. 24 Griffin Mill

Pulverizing Machinery

For Most Every Purpose—

For Cement Plants—Fertilizer Plants—Agricultural Limestone Plants, Etc.—Etc.

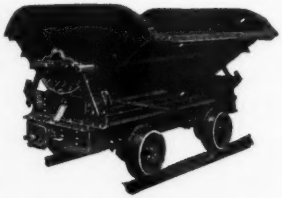
Reducing

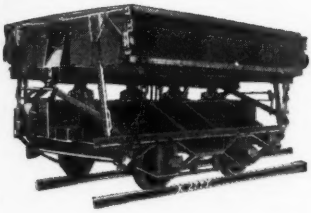
Cement Clinker—Cement Rock—Limestone—Phosphate Rock—Agricultural Limestone—Rock Dust for Mines—Gypsum—Etc., Etc.

Out Puts—1-40 Tons per Hour
Fineness—20-200 Mesh

BRADLEY PULVERIZER COMPANY
BOSTON Works: ALLENTOWN, PA. LONDON

It can't be done





You can't successfully buck Quarry conditions with cheap poorly made cars—it simply can't be done.

Wise Quarry men prefer Koppel cars, for they have known from experience that they can be depended upon to stand the gaff—stay on the job and render excellent service.

Koppel Quarry cars are made in many types and capacities—write for descriptive literature, or better still, let us suggest a car suitable for your conditions—no obligation.

Rails Switches Frogs Track KOPPEL

Koppel Industrial Car & Equipment Co.

KOPPEL, PENNA.

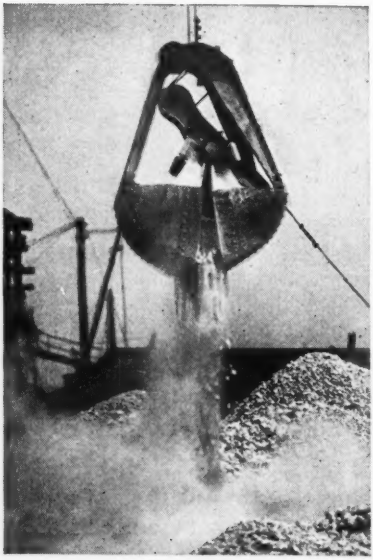
SALES OFFICES:

Pittsburgh New York Chicago San Francisco

KOPPEL *cars and tracks for* **QUARRIES**

MEAD-MORRISON

TYPE "W" GRAB



FAST DISCHARGE

NOTICE how the Type "W" Grab drops its load when the shells are barely open. Their deep-curved design gives almost instantaneous discharge with no time lost between trips. All kinds of materials, from fine sand to big rocks are handled easily and economically. Type "W" digs down as it closes, the powerful jaws filling the Bucket for a capacity load every trip. The terrific "bite" combined with the light weight of the Grab, variable rope reeving and attachable weights makes the Bucket **Universal in use**—as efficient on heavy excavating as on fast rehandling. It gives more pounds per load, more loads per day and dependable year-around service.

MEAD-MORRISON
MANUFACTURING COMPANY

1128 Prescott Street **East Boston, Mass.**

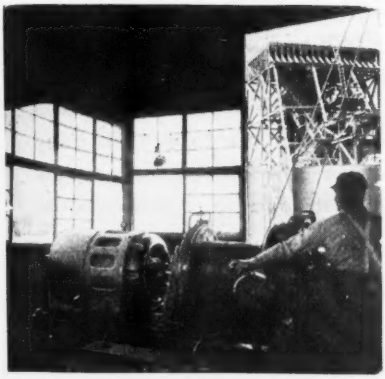
Digs and Delivers Bucket-Load a Minute to Top of Screening Plant

One of the latest improved Sauerman Slackline Cableways, operated by a Sauerman two-speed hoist, was timed for an hour at a sand and gravel plant while it was digging at a distance of 350 ft. from the plant. The bucket made 58 trips from the pit to the top of the plant during the hour, lifting a full load each time.

Another plant, using a 300-ft. span Sauerman Cableway equipped with a 3½ cu. yd. bucket to rehandle sand and gravel from under-water storage, reports an average 10-hour capacity of 3,000 tons.

If you wish to have the very latest information on economical handling of large tonnages of sand and gravel, write to us. We can give you some interesting facts and figures.

SAUERMAN BROS., Inc., 434 S. Clinton St., Chicago



The 1 cu. yd. Sauerman Slackline Cableway at the Stony Creek Gravel Co.'s plant shown below, has averaged 60 cu. yd. an hour for an entire day's run. The small view shows the interior of the hoist-house and the Sauerman 2-speed electric cableway hoist.

With the Right Grade of Grasselli—

Results Are Sure

WITH Grasselli Explosives in the borehole, you know the results you'll get, even before the shot is fired. You push down the blasting machine handle—the shot moves out—the stone comes down clean from the face. No dangerous overhangs—no toes—only a few blocks big enough for pop-shooting. That means fast loading, handwork or shovel, bigger production—lower costs.

For years many substantial quarrymen have depended upon Grasselli Explosives to get out their stone in the size and condition they want. They know from experience that the use of Grasselli Explosives means bigger net profits at the end of the year.

You, too, can depend upon Grasselli for making your quarry operations more profitable.

THE GRASSELLI POWDER COMPANY

Main Office: Cleveland, Ohio

Branches:

Philadelphia
Bluefield, W. Va.
Birmingham
Wilkes-Barre, Pa.
Brownsville, Pa.
Pittsburgh

Chicago
Clarksburg, W. Va.
Pottsville, Pa.
Hazleton, Pa.
New Castle, Pa.

The Grasselli Powder Co., of Florida, Miami, Fla.

GRASSELLI EXPLOSIVES

THE INSLEY EXCAVATOR

Not to do the work of a large shovel—But to do the work a large shovel can't do—PROFITABLY

A BASEMENT A DAY

The Brownwell Corporation of Detroit dig a basement with their Insley Excavator, move the machine and set it up in their new location all in a day's time. The average size of each basement is 35' x 25' x 5' and the distance between jobs ranges from one to five miles, although it is occasionally necessary to move clear across Detroit, a distance of twenty miles. It is easy to estimate the saving to them effected by this machine with a total daily operating expense of not to exceed twenty-two dollars.

The Brownwell Corporation ordered their first Insley Excavator the middle of August, 1925. After it had been in operation less than two weeks, it was so successful in its performance that they ordered another one.

In order to do such work satisfactorily, an Excavator must be primarily a good digger, and in addition it must be flexible enough to move about at a reasonable speed under any conditions wherever the digging is to be done.

With its low fuel consumption, one man control, and speedy operation, the Insley Excavator is a good digger, and is economical. With its long full crawler traction, extra wide crawler plates, easy control and ample power plant it is an excellent traveler under any conditions. It has a bearing pressure on the soil of about seven points per square inch, so that it can go over city streets without in any way damaging the street.

These qualities of ease and economy of operation and traveling, backed by the Insley reputation for sound design, good workmanship, and the best of service, make the Insley Excavator a valuable investment.

SUCCESSFUL PERFORMANCE

INSLEY

CONCRETE PLACING EQUIPMENT

STEEL DERRICKS

BUCKETS AND CARS

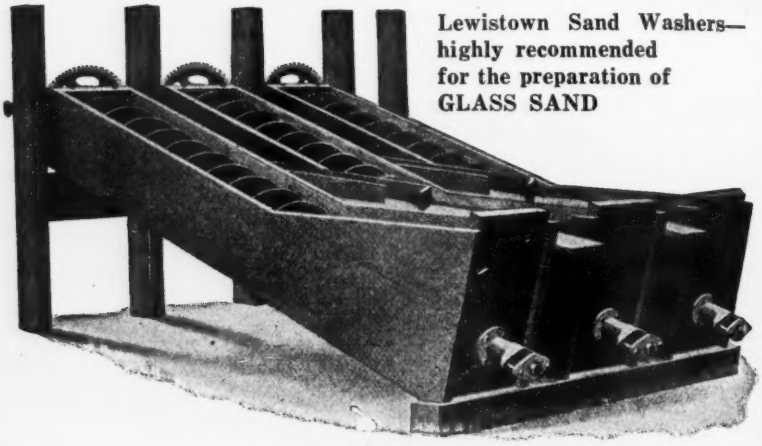
EXCAVATING EQUIPMENT

INSLEY MANUFACTURING CO.

Engineers and Manufacturers

INDIANAPOLIS

THE INSLEY IS LITERALLY A DIRT EATER EXCAVATOR



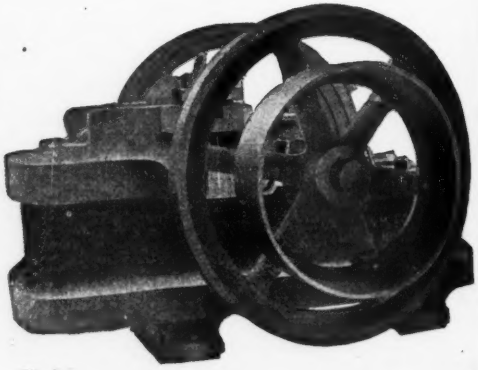
Lewistown Sand Washers—highly recommended for the preparation of GLASS SAND

IS YOUR PROBLEM LISTED HERE?

We are in position to help you meet your problem in a speedy, satisfactory manner, if it pertains to crushing, grinding, screening, washing, drying or conveying, for we manufacture a full line of this equipment for pit and quarry service.

These are reasonably priced, well built, compact outfits—efficient and quickly installed.

Will you drop us a line, stating what equipment you desire information on?



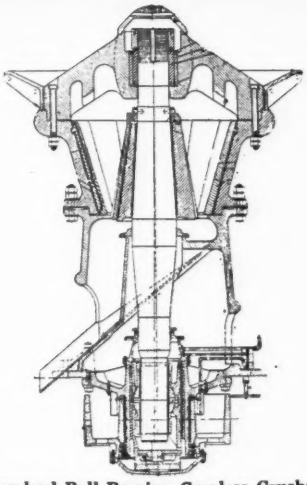
Lewistown Fdy. & Machine Co.

LEWISTOWN, PENN.

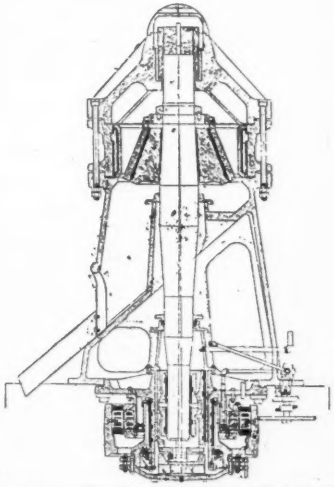
THE CRUSHERS
with the
Troubles Left Out

WHY THEY LEAD

1—They are noiseless and run like watches.
2—50% greater capacity for same power.
3—Practically no wear on anything but head and concaves.
4—Short shaft and saving in head room with packed dust collars.
5—Shaft reinforced with self-locking head so that it cannot break where 90% of shafts have broken.
6—Can be driven right, left, or standard, as sent from shop.
7—Eccentric is turned by flexible coupling attached to pulley, which prevents side thrust and heating, as in geared crushers.
8—Ball and socket eccentric, self-aligning, eliminating friction and heating. Runs for years without attention.
9—Positive circulating oil system through filter and cut geared oil pump.
10—Made in our own shop by experts, trained for the job.
11—It is a crusher with the trouble left out. See it in operation, and you are unfit to listen to any geared crusher salesman. In fact, if you are near one of his machines, you can't hear him, if you are so inclined.
12—Our fine crusher does the work of 4 geared crushers.



Standard Ball Bearing Gearless Crusher. Sizes No. 1 to No. 60—Weights 1,000 to 900,000 lbs.



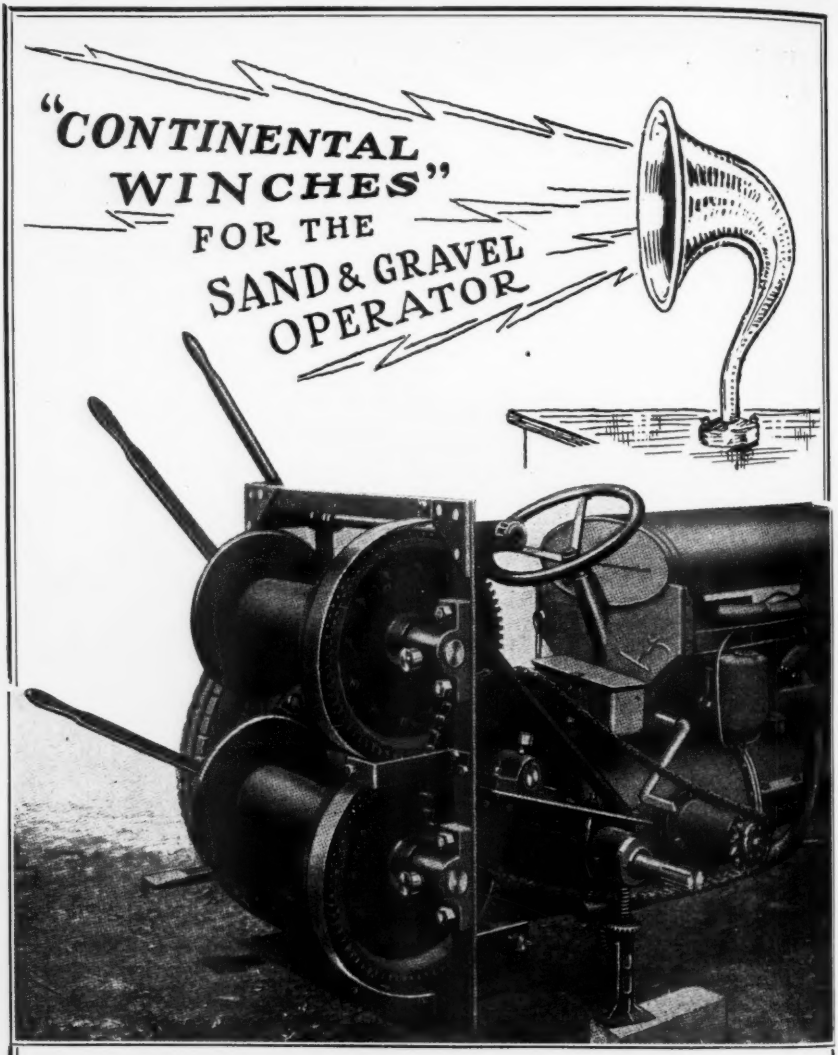
Gearless Crusher for Fine Crushing. Do not be deceived by Vertical Concaves; that is not what makes a fine crusher.

Send for catalogue and tell us what your problems are, and one of our experts will call on you without obligation on your part.

KENNEDY VAN SAUN MFG. & ENGR. CORP.

50 Church St. **NEW YORK**

Kearns Bldg., Salt Lake City, Utah
414 So. Spring St., Los Angeles, Calif.
Annex Hotel, St. Louis, Mo.
1739 Roanoke Bldg., Chicago, Ill.
73 Cullinan Bldg., Johannesburg, So. Africa
40, Rue des Mathurins, Paris, France



THE operator in the sand and gravel field requires a powerful, uniform hoisting unit. The Continental Winch fulfills these requirements and more, they prove dependable under any ordinary conditions. Whether the need is for portable or stationary work, the Continental is constructed to meet it. Continental Winches are made in two types—friction and gear drive—and come in two sizes—single and double drum.

The Fordson Continental Winch carries an unconditional guarantee against defective workmanship and material. The defective parts, if any, are replaced F. O. B. Memphis without charge. Know more about the Continental Winch by writing for our descriptive catalog.

UNIVERSAL EQUIPMENT CO., Inc.

1444 Riverside Blvd. P. O. Box 2673 MEMPHIS, TENN.

Free Service to our readers

For the convenience of readers who are in the market for equipment, our "Free Service" department will furnish on request any information, catalogs and prices on any machinery, equipment or supplies used in pits and quarries. The coupon below makes it easy for you. Simply check, sign and mail.

Pit & Quarry, Rand McNally Bldg., Chicago, Ill.

Pit and Quarry, Research Department,
Rand McNally Bldg., Chicago, Ill.

WE ARE IN THE MARKET for the items checked below, and would be glad to receive catalogs. prices or other information.

- ☐ Agitators
- ☐ Air Compressors
- ☐ Air Compressors, Portable
- ☐ Babbitt Metal
- ☐ Baffles
- ☐ Bag Filling Machines
- ☐ Bag Sewing Mach.
- ☐ Bags, Cotton
- ☐ Bags, Paper
- ☐ Balls, Grinding and Pulverizing
- ☐ Barges
- ☐ Barrels, Steel
- ☐ Belt Fasteners
- ☐ Belting, Conveyor
- ☐ Belting, Transmission
- ☐ Bin Gates
- ☐ Bins, Clay Tile Storage
- ☐ Bins, Concrete Storage
- ☐ Bins, Steel Storage
- ☐ Blasting Fuses
- ☐ Blasting Powder
- ☐ Bodies Steel Dumps for Motor Trucks
- ☐ Boiler Compound
- ☐ Boiler Skimmers
- ☐ Boilers
- ☐ Buckets, Conveyor
- ☐ Buckets, Grab
- ☐ Buildings, Portable
- ☐ Burners, Oil
- ☐ Cable Coatings
- ☐ Cableways
- ☐ Car Movers
- ☐ Car Pullers
- ☐ Car Replacers
- ☐ Car Wheels
- ☐ Cars, Bottom Dump (Gauge .....in.)
- ☐ Cars, End Dump (Gauge .....in.)
- ☐ Cars, Side Dump (Gauge .....in.)
- ☐ Cars, Steel Gondola
- ☐ Castings, Special Metal
- ☐ Chain Drive
- ☐ Chain, Conveyor
- ☐ Chain, Steam Shovel and Dredge
- ☐ Chaser Mills
- ☐ Chutes and Liners, Metal
- ☐ Classifiers
- ☐ Clips, Wire Rope
- ☐ Clutches
- ☐ Controllers, Electric
- ☐ Conveyor Equipment
- ☐ Conveyor Rollers
- ☐ Couplings, Flexible
- ☐ Cranes, Electric Traveling
- ☐ Cranes, Jib
- ☐ Cranes, Locomotive
- ☐ Cranes, Traction
- ☐ Crusher Parts
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
- ☐ Crushers, Hammer
- ☐ Crushers, Jaw
- ☐ Derrick Swingers
- ☐ Derricks
- ☐ Dippers
- ☐ Draglines, Cableway
- ☐ Draglines, Revolving Boom
- ☐ Dragline, Scraper
- ☐ Dredges, Dipper
- ☐ Dredges, Land
- ☐ Dredges, Sand Suction
- ☐ Drill Steel
- ☐ Drilling Contractors
- ☐ Drill Sharpening Machines
- ☐ Drills, Blast Hole
- ☐ Drills, Hand Hammer
- ☐ Drills, Tripod
- ☐ Dryers, Sand and Stone
- ☐ Dry Pans
- ☐ Dump Wagons
- ☐ Dust Collecting Systems
- ☐ Dynamite
- ☐ Dynamos, Electric
- ☐ Economizers, Fuel
- ☐ Elevating Equipment
- ☐ Engineering Service
- ☐ Engines, Gasoline (H. P.....)
- ☐ Engines, Gasoline Portable Power Unit (H. P.....)
- ☐ Engines, Hoisting
- ☐ Engines, Hydraulic Pumping
- ☐ Engines, Oil (H. P.....)
- ☐ Engines, Power Plant
- ☐ Engines, Steam
- ☐ Feeders
- ☐ Fire Alarms
- ☐ Fire Alarm Systems
- ☐ Fire Brick
- ☐ Frogs and Switches
- ☐ Fuses, Blasting
- ☐ Gas Producers

(Continued on next page)

To be used for .....

.....

Firm Name .....

Address .....

City ..... State .....

- ☐ Gears
- ☐ Generators, Electric
- ☐ Grapple, Stone
- ☐ Grate Bars
- ☐ Grates
- ☐ Gypsum Separators
- ☐ Hoisting Engines
- ☐ Hoists, Chain
- ☐ Hoists, Derrick
- ☐ Hoists, Drum
- ☐ Hoists, Hydraulic, Motor Truck
- ☐ Hoists, Hand, Motor Truck
- ☐ Hose, Sand Suction
- ☐ Hydrators
- ☐ Hydraulic Mining Nozzles
- ☐ Hydraulic Pipe
- ☐ Hydraulic Pumping Engines
- ☐ Hydraulic Valves (Pulpit and Indicator)
- ☐ Idlers, Belt Conveyor
- ☐ Industrial Railway Systems
- ☐ Kettles
- ☐ Kilns, Cement
- ☐ Kilns, Lime
- ☐ Lights, Carbide
- ☐ Linings, Bag and Barrel
- ☐ Loaders, Bin, Portable
- ☐ Loaders, Boom and Bucket
- ☐ Loaders, Box Car
- ☐ Loaders, Conveyor
- ☐ Locomotives, Electric (Gauge .....in.)
- ☐ Locomotive, Gasoline (Gauge .....in.)
- ☐ Locomotives, Steam (Gauge .....in.)
- ☐ Locomotives, Storage Battery (Gauge .....in.)
- ☐ Log Washers
- ☐ Lubricators
- ☐ Magnetic Separators
- ☐ Manganese Steel
- ☐ Manganese Steel Parts
- ☐ Metal, Babbitt
- ☐ Metal, Perforated
- ☐ Meters
- ☐ Mills, Chaser
- ☐ Mills, Tube
- ☐ Mixers, Plaster
- ☐ Motors, Electric (H. P.....)
- ☐ Motors, Gasoline (H. P.....)
- ☐ Motors, Gasoline Portable Power Unit (H. P.....)
- ☐ Motor Truck Dump Bodies
- ☐ Motor Trucks
- ☐ Nozzles, Hydraulic Mining
- ☐ Nozzles, Suction Screen
- ☐ Oil Burners
- ☐ Oils and Lubricants
- ☐ Perforated Metal
- ☐ Picks and Shovels
- ☐ Pipe, Hydraulic
- ☐ Pipe, Iron
- ☐ Pipe, Spiral
- ☐ Plows
- ☐ Powder, Blasting
- ☐ Powder Magazines, Steel
- ☐ Power Transmitting Equipment
- ☐ Power Unit Gasoline, Portable (H. P.....)
- ☐ Pulverizers, Hammer
- ☐ Pulverizers, Ring
- ☐ Pulverizers, Roll
- ☐ Pump Repairs
- ☐ Pumps, Drainage
- ☐ Pumps, Dredging
- ☐ Pumps, Sand
- ☐ Pumps, Water Supply
- ☐ Pyrometers
- ☐ Rail, Steel
- ☐ Roofing and Siding (Iron, Steel, Zinc)
- ☐ Rope, Manila
- ☐ Rope, Wire
- ☐ Sand-Lime Brick Machinery
- ☐ Scales, Automatic, Conveyor
- ☐ Scales, Track
- ☐ Scrapers, Power
- ☐ Scrapers, Team
- ☐ Screening Equipment

(See other side)

- ☐ Screens, Perforated Metal
- ☐ Screens, Rotary
- ☐ Screens, Vibrating
- ☐ Separators, Air
- ☐ Separators, Gypsum
- ☐ Separators, Magnetic
- ☐ Separators, Sand
- ☐ Sheaves
- ☐ Shovels, Electric (.....yd.)
- ☐ Shovels, Gasoline (.....yd.)
- ☐ Shovels, Steam (.....yd.)
- ☐ Speed Reducers
- ☐ Steel Barrels
- ☐ Steel, Drill
- ☐ Steel, High Speed
- ☐ Steel, Manganese
- ☐ Steel, Structural
- ☐ Stokers, Automatic
- ☐ Stone Grapple
- ☐ Stripping Equipment, Power
- ☐ Superheaters
- ☐ Swinger, Derrick
- ☐ Tachometers
- ☐ Tackle Blocks
- ☐ Tanks, Settling
- ☐ Tanks, Steel
- ☐ Tanks, Steel Welded for Air, Water and Gasoline
- ☐ Tanks, Wood
- ☐ Ties and Timbers
- ☐ Track
- ☐ Track Scales
- ☐ Track Shifters
- ☐ Tractors, Caterpillar
- ☐ Tramways, Aerial
- ☐ Transformers, Electric
- ☐ Trolley Carriers
- ☐ Trucks, Electric
- ☐ Tube Mills
- ☐ Turbines
- ☐ Unloaders, Bin
- ☐ Unloaders, Boom and Bucket
- ☐ Unloaders, Conveyor
- ☐ Wagons, Dump
- ☐ Washers, Log
- ☐ Washing Equipment
- ☐ Welding Equipment
- ☐ Winches
- ☐ Wire Cloth

To be used for.....

.....

Firm Name .....

Address .....

City ..... **State** .....

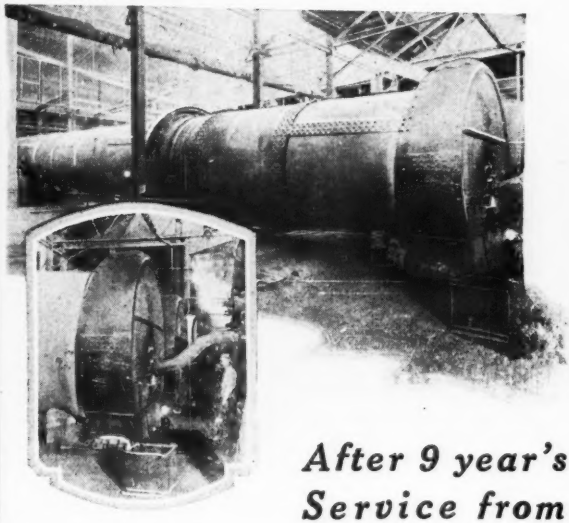
Ask any of these users—*they know!*

Pennsylvania Cement Company

Cowell Portland Cement Co., San Francisco, Cal.
Crescent Portland Cement Co., Wampun, Pa.
Cuban Portland Cement Co., Havana, Cuba
Dexter Portland Cement Co., Nazareth, Pa.
Glens Falls Portland Cement Co., Glens Falls, N. Y.
Great Western P. C. Co., Kansas City, Kan.
Helderberg Cement Co., Albany, N. Y.
Hudson Valley Portland Cement Co., Alsen, N. Y.
International Portland Cement Co., Ltd., Spokane, Wash.
Kosmos Portland Cement Co., Kosmosdale, Ky.
Lawrence Portland Cement Co., Siegfried, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Louisville Cement Co., Louisville, Ky.
(to be continued)

Vulcan Products

Hoists,
Electric and Steam
Locomotives,
Steam, Gasoline, Electric
Rotary Kilns, Dryers, Coolers and Heaters
Fairchild Double-Discharge Ball Mill
Mine Ventilating Fans
Cages and Skips
Sheave Wheels
Corliss Engines
Coal Crushers
Gray Iron Castings
Open Hearth Steel Castings
Gears, Moulded and Cut Teeth
Special Machinery



After 9 year's Service from 3 Vulcan Kilns they ordered a fourth!

The 9-year service record of three Vulcan Rotary Kilns at the Pennsylvania Cement Company plant resulted in the purchase of a fourth.

The first three were installed in 1914 and the fourth was installed in 1923. All four—9 by 125 feet in their capacity for high production at a minimum cost of fuel, power, labor and maintenance.

Repeat orders, almost invariably are incident to the use of Vulcan Rotary Kilns wherever used.

The long and extensive experience of Vulcan Engineers enables them to design and build kilns which meet your kiln demands, no matter how severe or how unusual these demands happen to be.

If you have some special operation requirements which call for special kiln design, or if you have some tonnage or fuel problem, get in touch with us. You'll find a very valuable story in the latest Vulcan Kiln Bulletin.

VULCAN IRON WORKS
Established 1849
Wilkes-Barre, Pa.

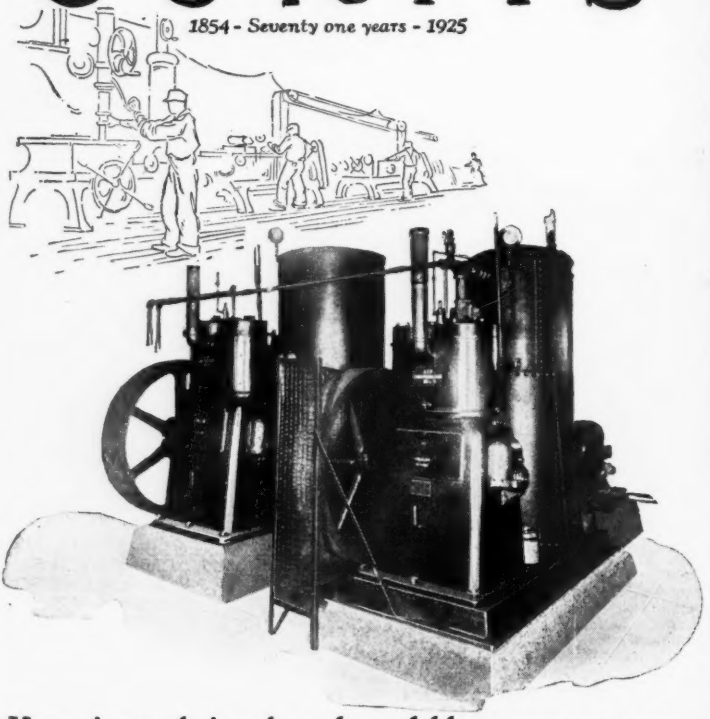
New York Office:
50 Church St.

Chicago Office:
McCormick Bldg.

VULCAN of WILKES-BARRE KILNS

CURTIS

1854 - Seventy one years - 1925



Your air supply is only as dependable as your compressor

In considering pneumatic equipment, it should be remembered that the air supply must be unfailing. Curtis Air Compressors are designed by engineers of world-wide reputation—the result of 71 years' manufacturing and 28 years' compressor building experience and manufactured as a unit in a great 17½ acre plant. This background is vitally important to you.

That the great plant of the Century Electric Company uses two large Curtis Air Compressors for supplying air power necessary for air painting, hoisting and other purposes, indicates dependable performance.

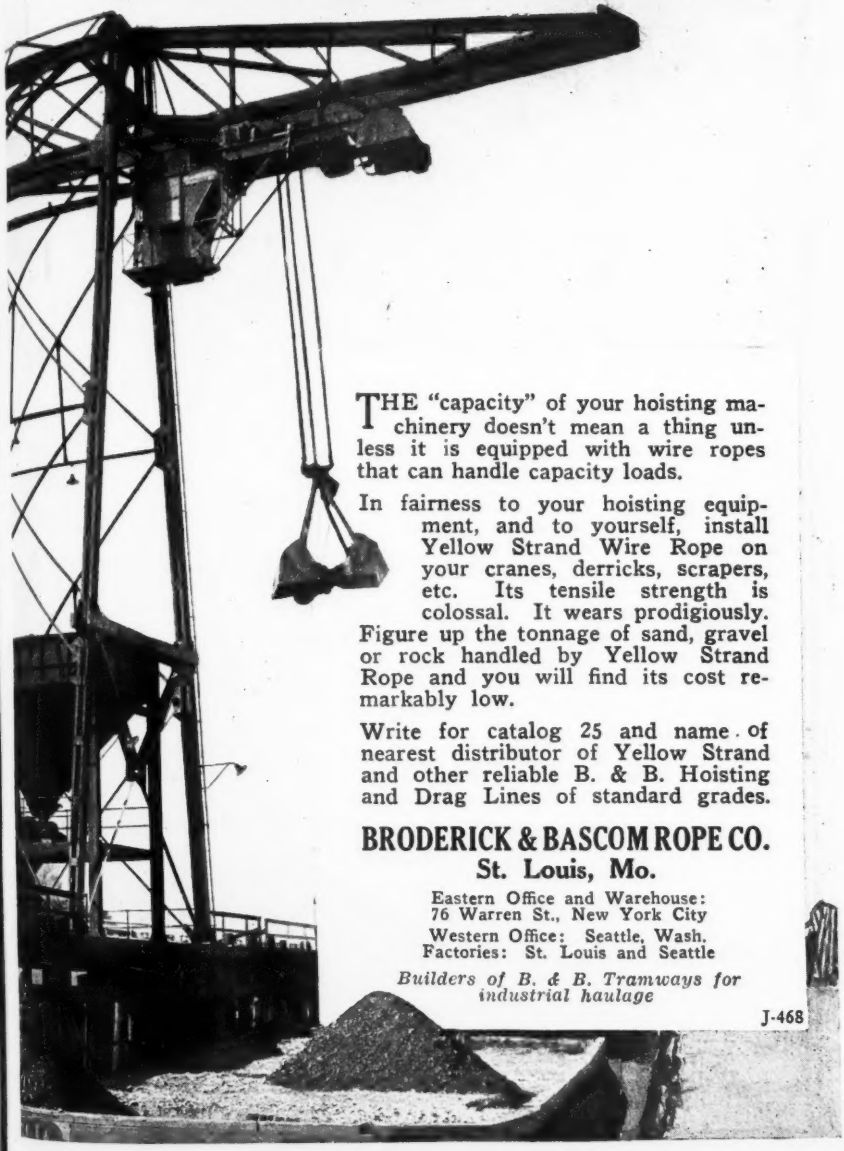
Curtis Pneumatic Machinery Co., 1628 Kienlen Ave., St. Louis, Mo.
Branch Office: 531-K Hudson Terminal, New York City

Gentlemen—Send me full details on Curtis Air Compressors and prices.

Name..... Address.....

Jobber's Name..... Address.....

Yellow Strand
WIRE ROPE



THE "capacity" of your hoisting machinery doesn't mean a thing unless it is equipped with wire ropes that can handle capacity loads.

In fairness to your hoisting equipment, and to yourself, install Yellow Strand Wire Rope on your cranes, derricks, scrapers, etc. Its tensile strength is colossal. It wears prodigiously. Figure up the tonnage of sand, gravel or rock handled by Yellow Strand Rope and you will find its cost remarkably low.

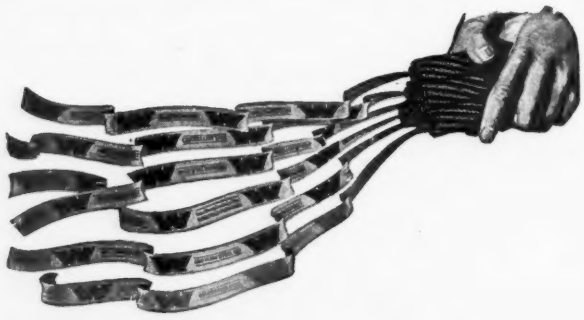
Write for catalog 25 and name of nearest distributor of Yellow Strand and other reliable B. & B. Hoisting and Drag Lines of standard grades.

BRODERICK & BASCOM ROPE CO.
St. Louis, Mo.

Eastern Office and Warehouse:
76 Warren St., New York City
Western Office: Seattle, Wash.
Factories: St. Louis and Seattle

Builders of B. & B. Tramways for industrial haulage

J-468



This is the only

WIRE ROPE

made that gives you an absolute unerasable proof of its grade (tensile strength).

In no other way can you be **certain** of the tensile strength of the wire rope you are using except through an expensive laboratory test.

Taking chances is one way of making your wife a widow and your children fatherless.

When you use a wire rope—the grade of which is uncertain, you're taking Big Chances. Why do you do this?

WILLIAMSPORT

provides a factory certified Telfax Tape marked proof of its grade.

This evidence cannot be altered.
It stays with the rope.

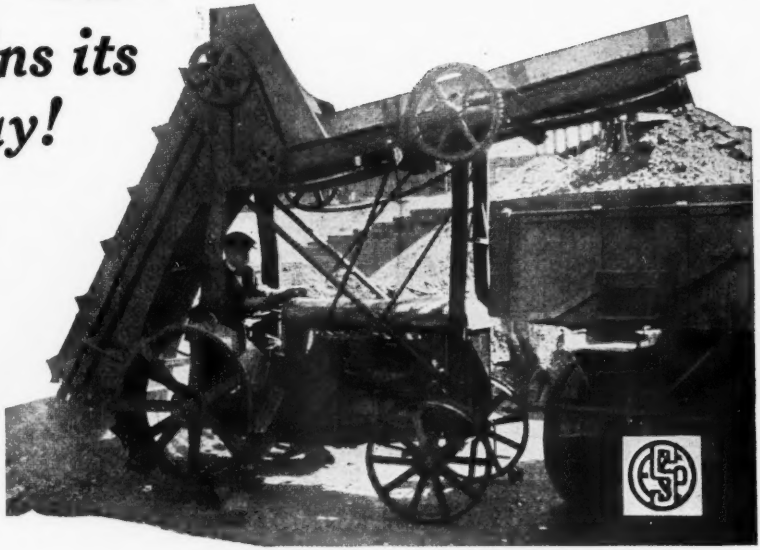
Williamsport Wire Rope Company

Main Office and Works
Williamsport, Pa.

Gen'l Sales Offices
Peoples Gas Bldg., Chicago

Specialty Fordson Loader

Wins its Way!



You Want the Best Loader Made!

The Specialty Fordson Loader is the answer to the demand for a portable loader moving and operating under its own power. There is no more compact loader made, for this outfit has much greater power than the conventional stationary outfit, and at but slight additional cost.

The Specialty Fordson Loader crowds while the buckets are in operation, independent of reverse gear, and it can be crowded much or little at a time. The crowding mechanism is self-contained with gears running in oil. The feeders clear a path sufficient for the tractor wheels. If you want simplicity of operation and dependability, install a Specialty.

Write for full information, mailed on request.

Specialty Engineering Company

Allegheny & Trenton Aves. **Philadelphia, Pa.**

It writes its own story.

With the CENTER DRIVE Truck

THE THEW SHOVEL COMPANY, LORAIN, OHIO

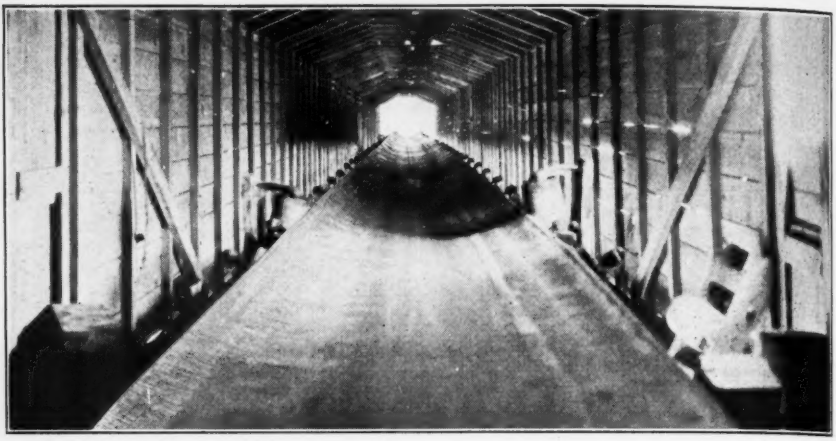
Thew Lorain Shovels

Dig Faster—Last Longer

Pit and Quarry

Index to Advertisers

Vol. 11 CHICAGO, ILL., NOVEMBER 15, 1925 No. 4



No Greasing for 7 Months But No Sign of Wear

The worth and superiority of Brownhoist belt conveyors has been demonstrated time and again to skeptical industrial plants. One of the most interesting of these demonstrations has recently been completed in the foundry of a nationally known automobile maker.

A standard Brownhoist roller-bearing conveyor idler was installed in a conveyor at this plant. It was boxed and sealed so that it would receive no lubrication or attention and put to work with other idlers which were oiled twice a day.

After seven months of day and night service, this Brownhoist idler was dismantled and minutely inspected. "No wear whatsover," was the inspectors' report. And the lubricant in the idler was almost as good as new.

Brownhoist roller-bearing idler design keeps dirt and grit out and grease in. Added to this they are locked into perfect, permanent alignment—two reasons why they last so long and give such dependable service. Catalog M-24 tells many more reasons. May we send you a copy?

The Brown Hoisting Machinery Co., *Cleveland, O.*

Branch Offices: New York, Chicago, Pittsburgh, New Orleans and San Francisco

BROWNHOIST

MATERIAL HANDLING MACHINERY

Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

Vol. 11 CHICAGO, ILL., NOVEMBER 15, 1925 No. 4

FEATURE CONTENTS

Pass it on

President

Vice-Pres.

Secretary

Treasurer

Gen. Mgr.

Sales Mgr.

Traffic Mgr.

Engineer

Supt.

Foreman

Purch. Agent

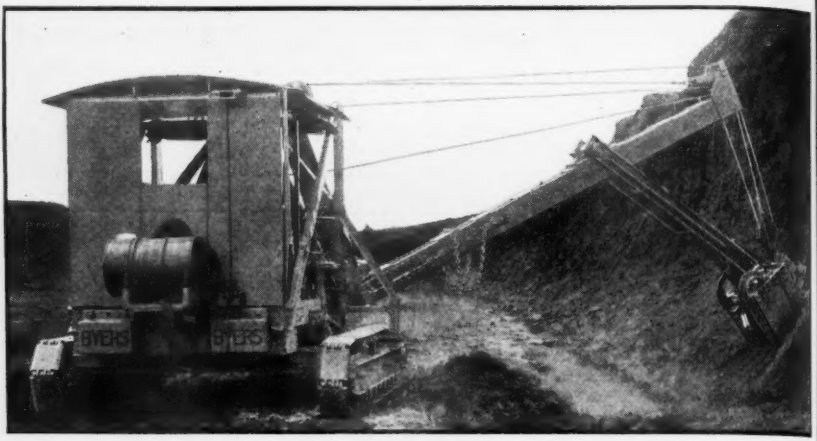
COMPLETE SERVICE PUBLISHING CO.
Rand-McNally Bldg., Chicago, Ill.

Publishers of
PIT AND QUARRY and Pit and Quarry HANDBOOK

HARRY W. BAUMGARTNER
President
V. E. LARSEN
Vice-President
W. A. WILSON
Advertising Manager
S. E. COLE, Eastern Representative
90 West Street, New York
Ph. Rector 4154

HAROLD W. MUNDAY
Editor

Associate Editors
E. D. ROBERTS
GEORGE B. MASSEY
F. A. WESTBROOK



Photographs of Mr. Wilson's machine were not obtainable; it is exactly the same as the machines illustrated above.

Digging Clay and Decomposed Granite

"SOME time ago, I bought one of your Bear Cat Cranes with shovel attachment. I used this shovel for digging clay and decomposed granite; this material we used for road surfacing.

"The ground was hard and in preparing for this job I expected to do considerable of shooting, so we had drills and powder on the job, but after the shovel arrived, they were excess baggage.

"The second pit was decomposed granite. I was skeptical as to our handling it without powder, but we worked here two weeks at 250 yards per day without the use of powder.

"This work was done on Division 9 of California State Highway between Mojave and Ludlow.

"I cannot praise the economy and dependability of shovel and motor too highly. It proved to be there on all occasions."

Yours truly, (Signed),
Harry Wilson.
Keeler, Calif., Sept. 21, 1925.

Now write and ask us what this ½ yard gas or electric shovel costs, and the operating expense, with only one man's wages to pay.

THE BYERS MACHINE COMPANY, Ravenna, Ohio

Sales and Service Throughout the Country

BYERS BEAR CAT

THE ALL-PURPOSE ONE MAN CRANE

Pit and Quarry

Vol. 11 Chicago, Ill., November 15, 1925 No. 4

The Foreman

By An Observer

OF all positions in which a man may be placed, that of foreman of a crew of men is one of the most particular. Why? Because he must have patience, judgment and a level head at all times. Unhappily there are few men who possess this healthy mixture to handle men successfully. There are scarcely two men whose natures are just alike. When the foreman finds out the kind of handling each man requires, then he must be governed accordingly. One foreman will be "hail fellow well met" with his men. In this he makes a mistake, for the old saying that "familiarity breeds contempt" is very applicable in this case; the men soon become so familiar with him that they lose all respect and get so they treat him and his orders with very little consideration; they get so they think he is of no more consequence than any other of the men; forget that his experience and executive ability entitle him to the position he holds; they soon begin to think he has no business to be over them, that they know more than he, and it is not long till they begin to disobey him, and he is compelled to have trouble with some of them.

However, in justice to the foreman, he is not in every instance to blame for not having complete control over his men. An unthinking manager or superintendent can upset the best laid plans of a foreman. We all know a business of any kind run without system is likely to be unsatisfactory to all concerned, and very often ends in failure, as far as discipline is concerned. I have in mind quite a large cement plant which is run without much system. In this particular place a foreman will arrange the men in his department to suit him; in a little while the superintendent comes along and re-arranges things somewhat. Later on the manager comes on and has some different ideas about things generally. Does he go to the next superior officer to himself to have his ideas carried into effect? No, he goes directly to the men and gives his orders, and thus tramples down whatever authority the superintendent and foreman might have, and which he is paying them for using for the advancement of the business. Pretty soon one of the workmen is approached by the foreman, and in a mild and rather tremulous voice is asked to rush this or that part of an order. Without hearing him further, the workman tells him the manager told him to do this or that and is going to complete the job. Other men give him like answers. Now, how can a foreman take an interest in the business when he is confronted with such a state of affairs and has no means of redress? When the manager hires the men and places them in their respective positions, and expects to give orders direct to them, what does he want of a superintendent and several foremen. It has often puzzled me.

So it is not hard to see that in determining working conditions the foreman is, to a large extent boss; but I do not mean to infer that the foreman alone should be responsible for insuring good working conditions. The responsibility of developing good foremen rests solely upon the shoulders of the manager. He has opportunities to study other plants, other methods with which it is difficult for his foremen to be in close touch, and the best of his observation should —as far as it is practical—be adapted to his own plant and his own foremen.

Improving working conditions, I feel, is a cooperative work—one in which manager and foreman must pull

together to the limit of their respective abilities; and I feel that no manager should refuse to change any given set of working conditions according to recommendations made by the foremen and found to be practical. Nor should he hesitate to bring forth suggestions of his own for approval or rejection by his foremen.

Another frequent cause for non-efficiency in a concern is a want of harmony between the foremen of different departments. Personal feelings take precedence of duty to the employer and his interests suffer in consequence. The foreman who can rise above prejudice and do his duty regardless of any private opinion he may have of the other foreman is the one whose merit ought to be recognized by his superiors, and in all probability will be. Undoubtedly many such differences could be smoothed out by the use of a little tact on the part of manager or superintendent.

That the foreman should be loyal to his employer and keep to himself any matters of business of which he is cognizant by virtue of his position goes without saying. The "blabber" cannot expect to be selected for any place of importance. In short, the perfect foreman must possess all the virtues and none of the vices and also be especially adapted to his work. The proverb has it that the leopard cannot change his spots and it is probably true that an efficient foreman cannot be made of a man who lacks certain natural qualifications but it behooves all who are occupying such positions to see that their work does not suffer because they lack others that can be acquired. Being but human, we are all poor enough at our best.

Standardization In the Non-Metallic Field

STANDARDIZATION in the non-metallic mineral industries so far as equipment is concerned presents to the manufacturer a varied array of economic hindrances and unless such hindrances are removed the advisability of standardization as an industrial policy is very uncertain.

Without attempting an exhaustive analysis, the hindrances may be summed up under five heads: First, the custom of manufacturing to meet special problems; second, the lack of standardization in other industries; third, the demand for wide variety on the part of many producers who in turn in some instances find it necessary to produce a variety of product; fourth, the possibility of loss of business; and fifth, the fear of competition and the tendency toward industrial monopoly.

Many manufacturers serving the non-metallic mineral field have for years followed the plan of suplying equipment according to individual needs and to change this policy would involve many readjustments not easily attainable. Manufacturing according to individual specifications is probably uneconomical. But the fact remains that a good deal of business in connection with screens, conveyors, elevators, etc., is and always will be special.

Considerable of the equipment being used in the non-metallic mineral field is also used in other fields. Will the standardization necessary in these other industries conflict? Some system of cooperation will need to be evolved that these varying interests are brought together.

The demand for variety by the producer who is serving a market that calls for variety is a difficult problem to solve. A crushed stone or sand and gravel producer may have a highly profitable market in serving varying specifications. Will he be deprived of some of this market through standardization? The problem, of course, is for the producer in turn to convince his buyer that standardization is also necessary in the production of crushed stone and sand and gravel.

The fear of competition is a real factor. If everybody produces the same thing, the dog-eat-dog spirit may prevail. It may be that the manufacturer who secures the greatest efficiency and lowers his cost by quantity production will be in a position to undersell his competitors and eventually secure a monopoly.

While some of these hindrances are largely imaginary, nevertheless they may be overlooked. If the movement for standardization continues to grow, these and other problems will need to be considered.

Economy in Producing Sand and Gravel

By George Ransom

BALANCED operations are not any too frequent in the sand and gravel industry. Securing a balance in production between the pit, crushing, screening and washing operations is not always possible. However, in the case of the Iron Ledge Company it is possible and economical. This company is producing sand and gravel in the town of Trumbull, Connecticut, which is adjacent to Bridgeport. As Bridgeport is a thriving industrial city with a good deal of construction work always in progress, the sand and gravel business consequently thrives especially with the Iron Ledge Company as they feature service facilities.

This plant produces various sizes of gravel and two grades of sand, approximately 50 per cent of the total output being sand. The material has a hard, granite-like structure, and a high compressive strength. The gravel and sand are used in making concrete foundations, highways and sidewalks. In some cases the gravel is employed alone for dressing highways. The ⅜ inch gravel is used in school yards and for house roofs. There are two grades of sand, the finer being employed in making brick and the coarser for concrete work. Occasionally the two grades of sand are mixed, and at times there is a demand for a mixture of coarse sand and ⅜ inch gravel. The smallest gravel produced passes through a ⅜ inch ring size mesh. This amounts to about 20 per cent of the gravel output. The next size is ¾ inch, and this comprises about 30 per cent of the gravel output. The remainder is 1¼ inch.

The normal production of 250 yards per day is accomplished with the help of only five men in the plant and a superintendent, who also spends considerable time in the Bridgeport yard, as will be explained later. Such a record of efficiency and economy can, of course, be made only by the use of every possible labor saving device and very competent supervision. Mr. Broadbent, the superintendent, who also designed the plant, is responsible for the latter.

This is distinctly a pit operation and includes washing the gravel. Stripping is carried on with a steam Keystone grader which also loads the material. This can be sold, as well as the gravel, for grading and filling purposes in connection with the extensive development operations in Bridgeport. It is, of course, an important item in meeting the rather keen competition existing in this district.

Every variety of sand and gravel, as well as cobbles, is obtained. There are sections where pure sand is found which does not need grading or cleaning and others where there are clay and cobbles. At one time a drag line was used with good results, but the present workings contain too much clay and too many large cobble stones and occasional boulders for this method to be successful.

The material is excavated by means of a Thew steam shovel, which combines excavating and loading into one operation by placing it directly in

General View of Iron Ledge Company's Sand and Gravel Plant.

Steam Shovel in Pit.

dump cars of three cubic yards capacity. These dump cars, which are home made and equipped with automatic trip swinging end doors, operate on narrow gauge tracks extending from the scene of excavation to the top of an incline above the scalping screen and crusher. They are hauled by means of a locomotive. This locomotive is capable of pulling three cars at a time to the foot of the incline. The larger cobbles are generally thrown out, in so far as possible, either at the steam shovel or at the incline.

The incline has an angle of about 30 degrees. One car at a time is pulled up by means of a ⅝ inch Roebling cable and a motor driven Lidgerwood hoist equipped with a reduction gear. This gear, with which several motors in this plant are provided, is made by the Bridgeport Motor Company which makes a specialty of this sort of thing. The motor is a 25 h.p. self-compensating Century induction motor.

As the dump car reaches the top of the incline, it is automatically dumped by means of the simple device shown on the rear of the cars in one of the illustrations. The material then drops into a hopper from which it passes to the scalping screen. A steady, constant flow to this screen is maintained

Locomotive Hauling Dump Cars Equipped with Automatic Release Swinging End Doors.

by means of a Telsmith plate feeder operated by an eccentric. This feeder has saved the labor of two men employed previously in hand feeding. The saving amounts to $12.60 per day. The screen is an Allis-Chalmers heavy duty screen and is simply used to scalp out marketable material. There is no grading at this point except that the largest size of gravel delivered from the final grading screen is determined by the size of the scalping screen. As a matter of fact three different sizes of scalping screens are kept on hand, and the one in use at any given time depends on the customers' orders then being served. The sizes are ¾ inch, 1 inch and 1¼ inch.

The material rejected by the screen, that which does not pass through it, in other words, drops into a Champion number 4½ crusher. The crushed stone is then taken back by a bucket elevator (made by the Good Roads Machinery Company) whence it again goes into the scalping screen. The material which passes through the scalping screen is deposited on a Webster belt conveyor. This has a length of 150 feet between centers of drums and is 20 inches wide when flat or 18 inches with operating curvature. The belt of the conveyor has been in use for a number of years, and although it has given very satisfactory service, it has been necessary to replace a short section which was accidentally damaged. Alligator X65 belt fasteners were used for this purpose and have proved adequate to the service requirements.

The belt conveyor discharges into a washing box where mixed sand and gravel is washed into the Telsmith washing machine by a stream of water delivered at the rate of 250 gallons per minute, from a 7 inch spirally riveted pipe having a 5 inch opening. The screen grades the material into sand, grit (¼ inch), ¾ inch and 1 inch sizes. This screen is equipped with a heavy cylindrical roller on the outside which pushes back the grit which sticks in the openings and would otherwise plug them up so that nothing could get through.

The first section of the screen is a solid cylinder containing baffles. This might well be called a scrubbing section. In the second portion of the screen there are very fine meshes which permit the sand now mixed with water to drop through and pass into the first Telsmith sand settling tank. The gravel moves farther down in the rotary screen, and each size drops through the correct mesh and into chutes, from which it goes to storage piles or bins. The gravel above ¾ inch size is discharged from the end of the screen.

There are, in addition, two Telsmith settling tanks which may be adjusted to furnish two different grades of sand automatically. The ordinary sand is used for concrete work and the fine sand, or "asphalt sand," is used for asphalt work and the making of concrete blocks. Even the finest sand from this operation is sharp and of very good quality. This material was formerly considered waste but in the effort to make use of as much of that excavated as possible, a very satisfactory market for it has been developed.

When the mixture of sand and water falls into the first Telsmith

Incline At Top of Which Cars Are Dumped Into Hopper Which Feeds Material to Scalping Screen

Detail of Elevator from Crusher to Scalping Screen.

settling tank, the coarser material immediately drops to the bottom. Water is continually fed into this tank and overflows into the second Telsmith tank. The finer material, which remains suspended for some time, flows over with this water and in the second tank more of the finer sand settles out. The overflow from the second tank, which contains mostly dirt, falls into a trough and is discarded. The Telsmith tanks are supported on knife edges, which allow them to rotate a small amount about an axis across the top and a little to one side of the middle. When a tank fills up with sand, its center of gravity changes, and it rotates on the knife edges, causing a system of two levers to open an automatic valve at the bottom of the tank. When a sufficient quantity of sand has flowed out of the tank, it returns to its former position, and the valve closes automatically.

Formerly the good sand was separated from the mud by means of one large settling tank containing two endless manganese steel chains on sprockets. On these chains there were mounted steel plates or baffles, which stirred the sand and water. The plates scraped up the sand at the bottom and dragged it over the one inclined end. This tank was about 16 feet long, 3 feet wide and 4 feet deep. The power consumption varied between 4½ and 5½ h.p. This tank involved quite an expense for power and it had a good many moving parts which caused trouble. It was found that the maintenance labor was considerably more than the system justified. Fur-

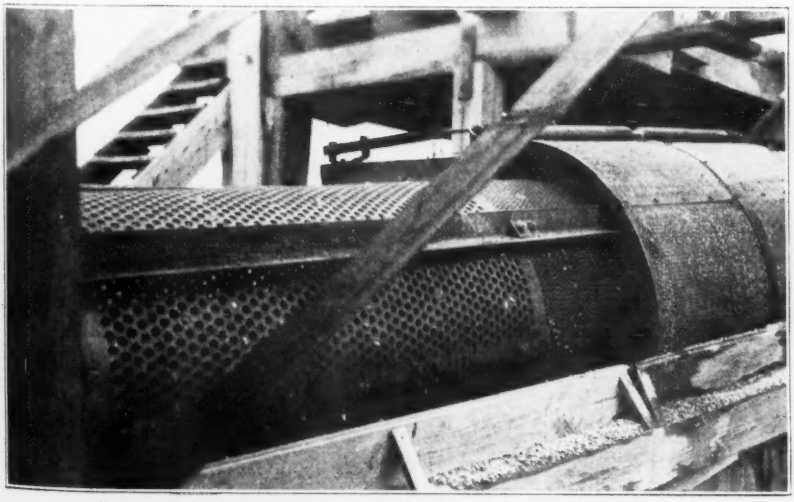
Storage Pile of Sand Discharged From Settling Tanks.

thermore, the sand obtained was not as clean as that which is now secured. Some of the sand washed in the old settling tank is still on hand and a very marked difference between it and the sand now produced can be seen.

The water for washing is taken from a brook about 600 feet away. The head is 70 feet. A motor driven Gould centrifugal pump is used to furnish the supply.

The graded material is deposited in bins having a total capacity of about 700 cubic yards under which the motor trucks are loaded. When the bins are full, the surplus is piled outside. Gravel is taken out to these piles by means of a short Webster belt conveyor. There are two small wooden structures extending out at different angles from the washing and grading machinery to which the belt conveyor is moved in turn as different storage piles are made. The sand for the storage piles is washed out through a spirally riveted pipe which is movable over a sufficient radius to build up a number of piles. Additional lengths of flanged pipe are bolted together when necessary to deposit the sand at greater distances. Loading trucks from the storage pile is done by means of a Jeffrey portable loader. Deliveries are made with 5-ton trucks capable of carrying 5 cubic yards each. Three of these are Mack trucks equipped with Heil hoists, and two are Federal trucks with Wood hoists. The Mack trucks actually have 4 yard bodies and the Federal trucks 4½ yard bodies but by piling up the material it is possible for them to carry five yards. All trucks loaded at the plant in Trumbull would, in any event, have to pass very close to the Company's office on the outskirts of Bridgeport,

View of Dumping Platform, Scalping Screen, Bucket Elevator and Belt Conveyor.



Close-Up of Washing Screen.

two miles away, so that they all stop at the latter place, where the Standard scale is located, for weighing.

In addition to the material from its plant, the Iron Ledge Company also supplies crushed stone which it obtains from outside sources. This is brought in over the Berkshire Division of the New York, New Haven and Hartford Railroad which is here located adjacent to the Company's Bridgeport yard and at a considerable elevation above it. It has thus been possible to construct economically, a siding over bins, or pockets, from which trucks in the yard can be loaded with great ease. In fact, there is sufficient spare capacity in bins to permit of renting facilities to local coal companies for unloading cars and loading trucks—a profitable source of revenue.

The fact that this Company operates successfully in the face of considerable competition is due, of course, to good management. In the first place, the service rendered to customers is given very careful attention, and every effort is made to arrange deliveries in such a way that no contractor is ever idle due to lack of building material. This involves not only considerable planning at the office but due attention to the character and management of the drivers. The plant, as already stated, is operated by five men. These are distributed as follows:

1 man on the shovel
1 man on the dinkey
1 man to hook up and unhook the cars
1 man on the hoist
1 man on the plant who watches the machinery.

In very busy times a sixth man is employed as a general handyman to keep things picked up and help wherever directed.

Furthermore, all machinery is electrically driven with self-compensating Century motors. This, of course, reduces attendance to a minimum. Where belt drive is employed as for the crusher, Blue Streak belts are used. Careful attention is also given to the proper lubrication of all machinery; for instance, the grease cups on the belt conveyor are turned down a little every day, and Mr. Broadbent sees to it that this is done.

Perhaps one of the most important, as well as sensible, steps in securing a high degree of efficiency is that full use is made of the technical service rendered by manufacturers of equipment, which is as satisfactory from the standpoint of the manufacturer as from that of the operator. The superintendent, Mr. Broadbent, not only keeps track of production and maintenance at the plant, but he also has charge of the drivers and the company garage at the Bridgeport office. This means that he has charge of the upkeep of the trucks and, in fact, he makes all of the minor repairs and many of the major repairs himself. Sometimes he instructs others at the garage how to do the work and supervises them, when this is practicable.

Bins for Crushed Rock, Gravel and Sand from Which Trucks Are Being Loaded.

Exchanging Views and Experiences

By R. N. Van Winkle

SHOULD I be asked to criticize constructively the owners and operators in the quarry industry, I should say that they are, as a whole, too reticent, too backward in exchanging views and experiences on operating matters and management, and too reluctant in taking advantage of the possibilities available for the betterment of the industry as a unit and themselves individually. In making such a statement I am including myself; for I am a quarry owner and operator besides being engaged in engineering consulting practice in the quarry and open pit mining industry. It is this consulting work which has broadened my views and opened my eyes to the point where I do not hesitate to make this criticism with all sincerity.

All of us, irrespective of our experience or years of faithful application to the problems of the quarry industry, are in a position to learn and gain by an open and fair minded exchange of experiences and by constructive criticism. If we are not, we are like the man of whom it was said, "I never heard a good word said of him." The reply was, "Then you have never heard him talk about himself." Quarry operators are not egotistical, but are quite the reverse, too tight mouthed for their own good and the good of the industry in which we all have a mutual interest which should bind us together.

These exchanges of experience on subjects of vital interest and importance might be carried on through the columns of the trade journals of the industry in the form of an open discussion or friendly debate. There are many subjects which should be of interest, such as sales practices, discounts, collections, demurrage, freight rates, lack of cars, cars in bad repair, cars placed for loading containing cinders or rubbish, rates of electric power contracts, workmen's compensation insurance, liability and fire insurance, safety methods and practices. This list does not cover the subjects which would make interesting as well as constructive reading, but it gives an idea of the possibilities of such a plan. If you were asked how a young man can obtain data or information on business management and operating practice in the quarry industry, what would be your recommendation unless you said, "Get a job and learn the business as I have learned it from experience, some costly mistakes and hard knocks." In reality this is about all a man can do, for there are no handbooks, cost data or text books covering the quarry and open pit mining industry, as there are for mining, contracting and kindred lines of industry.

For an example, let us consider drilling and blasting. Very little has been written and is available about these important subjects as they apply to the quarry industry. It is true that manufacturers of explosives and explosive accessories as well as manufacturers of drills and drilling equipment publish handbooks and catalogs on the subjects and maintain in many instances engineers and technical departments for giving advice. This advice, however, is primarily selling advice given for the purpose of promoting sales of the product, and is consequently not altogether unbiased advice. To illustrate the point, suppose you are contemplating the purchase of a steam shovel. This becomes known, and the steam shovel manufacturer sends representatives or sometimes a sales engineer to interview you. This salesman comes primarily to sell you a shovel, not to give you advice about steam shovels in general and steam shovel operations. Any general advice that is given is offered in good faith, but it is not the result of experience or study of the subject. For instance, much publicity has been given to caterpillar mountings in place of traction or railroad type mountings for steam shovels in quarries. These caterpillar mountings are being manufactured to sell and sales promotion efforts are put on them, but in my opinion caterpillar mountings on steam shovels in quarry operations are not successful and are not adapted to every operation as we might be led to think.

In the matter of explosives and explosive accessories let us consider Cordeau. The introduction of Cordeau into this country was unquestionably a great thing for the quarry industry, but I do not believe that Cordeau is

the best and most economical detonator for all blasting. There are many places where the electric exploder still serves best and cheapest even in column loading in bank shooting in quarries. Drills offer another illustration. There are several standard makes of drills all manufactured for the express purpose of selling and all of them good outfits for certain particular drilling operations. Every good salesman attempts to convince you that he has that certain outfit particularly adapted to your special requirement, "tailor made" just for you. Perhaps he has, and perhaps he has not. How are you to decide? Would the experience of other operators with similar quarries help you in making a decision? Would the advice of an unbiased consulting engineer be of assistance to you, or are you willing and satisfied to rely on your own judgment in the matter?

Last May I wrote for Pit & Quarry a series of articles on "Blasting Practice in Quarry and Open Pit Mining." The purpose in writing this series was to give the quarry and open pit mining fraternity condensed, reliable and unbiased information pertaining to explosives and blasting in their industry. Readers were invited by the Editor to correspond with us on the subject giving comments and data from their experience and knowledge which would be of value in the study of blasting practice. Some of the comments and criticism received from the readers and replies to them will be convincing evidence of the value of open discussion and debate. From one reader the following comments regarding tamping explosives were received:

"The writer has been following your series of articles on explosives in Pit and Quarry with a great deal of interest. We note that you use a tamping stick on the end of a rope for loading well drill holes and are wondering whether you ever heard of an accident being caused by tamping dynamite into well drill holes in such a manner. Your practice seems to follow exactly what we have been doing. We were recently told, however, by a representative of a powder company that it is dangerous to tamp well drill holes. We are at a loss to understand why he should make this statement as we use only wooden tampers on the end of ropes in which there is no metal whatever. Certainly failure to tamp a hole would result in the loss of a great deal of efficiency. So far we have not had any trouble and are wondering whether you ever heard of an accident being caused by tamping well drill holes."

The reply to this inquiry was, in part, as follows, "Regarding the use of a tamping stick on a rope, I have never heard of an accident of any kind resulting from this practice. Of course, one should not let the tamping stick drop into a deep hole, and one should use caution in tamping the primer cartridges . . . I am certain that the method which I outlined in my articles is a commonly accepted practice throughout the United States."

From another reader who is experienced and fully qualified to pass judgment the following was received:

"I have read with considerable interest your articles on the above subject in Pit and Quarry and have no doubt that they will have a very beneficial effect on quarry operations in general, as it has been my experience that the owners and operators of quarries are very much given to slighting their explosive problems and not giving them the personal attention which they deserve. They seem to consider explosives in the nature of a disagreeable necessity of which the less they use, the better, and are only interested in the price that they pay for them, without considering at all the work accomplished by them.

"There are a few points in the August 15th issue of Pit and Quarry which I should like to discuss. One is the sign "Explosives—Dangerous," which a good many quarrymen put on their magazines. Our own practice has found this inadvisable as stray hunters and shooters are liable, at a distance, to assume that these buildings are deserted and take the sign as a convenient mark for rifle practice. For this reason we do not put such signs on the magazines themselves even though they are bullet proof, but mount them on posts and stakes surrounding the magazine instead.

"Under your definition of detonator, you say it is usually referred to as a cap or exploder, which is perfectly true, but in the explosive industry they always refer to it as a blasting cap or electric blasting cap in order to differentiate as strongly as possible between the dangerous articles and the toys used by children in cap pistols. We should try to get away from the word exploder as referring to

an electric blasting cap owing to the fact that this term is used in Great Britain to designate a blasting machine.

"Another term which we are trying to avoid is lead wires. As spelled, it leads one, unacquainted with explosives terms, to think that it is a wire made out of lead, which is spelled the same way; and as wires of lead are sometimes used in connection with cutouts of power circuits, it leads to confusion. Therefore, we always speak of the wires which connect the blasting machine with the charge as leading wires.

"Among your 'don'ts' you say, 'Don't use electric caps or exploders with iron wires.' While this is perfectly good advice as regards quarry practice, it does not apply to coal and salt mining where iron wires are used almost exclusively, as they are perfectly suitable for coal mining where only one shot is fired at a time, and are almost necessary in salt mining where it is necessary to remove the wire bits from the salt by means of electro-magnetic separators and where small pieces of copper in salt sold for tanning hides exerts a very deleterious effect."

The reply to this letter was, in part, as follows, "I am aware that signs placed on magazines are sometimes used as targets by hunters and boys, and the practice which I have always followed was to put these signs on posts instead of on the building proper, and possibly I should so have recommended in my article.

"In reference to detonator being referred to as a cap or exploder, you are doubtless right, but I did not know that the word exploder was used in England to designate a blasting machine.

"Your point as to using the words 'leading wires' instead of 'lead wires' is quite proper for the reasons set out, but it has always been customary with me to use the term lead wires.

"As to the use of iron wires, I am familiar with the fact that electric caps or exploders with iron wires are used in the coal mining and salt mining industries, but my articles were dealing purely with blasting practice in quarry and open pit mining."

The series of articles referred to was intended to embody information which had actually been proved by experience to be of practical value. It was our purpose to present the information without using technical terms, so that it would be understood by the worker. In this regard one reader wrote the following:

"I think you are entirely right in believing that there is no comprehensive data published covering drilling and blasting in quarry and open pit mining, and I wish to say to you that all the operating members of our organization have read your articles and discussed them with a great deal of interest and profit.

"The writer personally has been following very much the methods outlined in your series of articles with the result that during the last twelve months we have materially decreased the amount of well drilling required as well as the amount of dynamite used in our various quarries."

Such open minded replies reflect well on operating practices and indicate that the methods and recommendations are being followed with satisfactory results. It is my opinion that failures in quarrying operations and management are due to misdirected or neglected efforts and unqualified advice rather than to lack of opportunity.

The non-metallic mineral industry is no longer an orphan but is fast becoming a full fledged, recognized and basic branch of industry. Quarrymen now have their State, District and National Associations; they have recently organized a Quarry Section of the National Safety Council, which is an important step in their progress. Now let us have an open exchange of ideas, friendly debate or public interchange of experience in matters of management and operations, carried on through the columns of our trade journals. Thus a record can be kept, thereby giving us tangible information, a text book of reference on matters of management and operations.

Many owners and operators will feel that they have not the time or the inclination for writing their views and experiences. In many instances they minimize their own ability in this line. Their experience, knowledge and ideas are of value to others in the industry. Those who do write render a service to others which is appreciated. They, too, may feel unqualified when the suggestion is first made. The ideas which we exchange are the important thing, not our ability to express them.

Quarry Accidents in 1924

Accidents at quarries in the United States in the calendar year 1924 resulted in 138 deaths and 14,777 injuries, according to statistics compiled by the Bureau of Mines, Department of Commerce. The figures compare with 142 deaths and 14,990 injuries at the quarries during the year 1923. The fatality rate for 1924 is the lowest recorded since the Bureau of Mines began, in 1911, the compilation of accident data for the quarry industry. The nonfatal injury rate, while slightly below that for 1923, was somewhat higher than the rate prevailing in recent years. The fatality rate for 1924 was 1.63 per thousand full-time or 300-day workers; the injury rate was 175.03. In 1923 the fatality rate was 1.68 and the injury rate was 176.04.

Reports from operating companies showed that the quarry industry employed 94,242 men during the past year, a gain of 2 per cent over 1923; that the volume of work done by the employees was equivalent to 25,327,858 man-shifts, a loss of 1 per cent; and that the employees averaged 269 workdays per man, a loss of 7 days per man.

The slight decline in the fatality rate in 1924 was due to a reduction in the rate for quarries producing limestone, slate and traprock. Increased fatality rates were indicated for quarries producing cement rock, granite, marble and sandstone and bluestone. Lower nonfatal injury rates were shown for cement-rock quarries, but all other classes of quarries showed higher rates than in 1923.

Operations inside the quarry pits employed 59,126 men, 3 per cent more than in the previous year; these employees performed 15,151,796 man-days of labor, a gain of less than 1 per cent; the men averaged 256 workdays each, a loss of 7.488 days per man. Accidents to the workers "inside" the quarries killed 96 men and injured 8,990 men, resulting in a fatality rate of 1.90 per thousand 300-day employees as compared with 1.97 for the previous year, and in an injury rate of 178.00 as compared with 178.11.

"Outside" the quarries, at crushers, mills, rock-dressing plants, etc., the employees numbered 35,116, or 151 less than in 1923; the men performed 10,176,062 shifts of labor during the year, a decline of 3 per cent; and the average workdays per man was 290, a reduction of 7 days per man. Accidents to the "outside" employees resulted in 42 deaths and 5,787 nonfatal injuries, and represented a fatality rate of 1.24 and an injury rate of 170.61, as compared with the previous year's fatality rate of 1.26 and injury rate of 173.65 per thousand 300-day workers.

Of the 14,915 accidents reported by the entire quarry industry during the past year, 138 (0.92 per cent) caused death, 13 (0.09 per cent) caused permanent total disability, 457 (3.06 per cent) caused permanent partial disability, 2,708 (18.16 per cent) resulted in temporary disability lasting more than 14 days, and 11,599 (77.77 per cent) resulted in temporary disability exceeding the remainder of the day or shift but not exceeding 14 days.

The main causes of all accidents inside the quarries were handling rock at the face, flying objects, haulage, falls or slides of rock or overburden, machinery, falls of persons, falling objects, and drilling and channeling, and timber or hand tools, in the order stated. Accidents outside the quarries were due mainly to flying objects, machinery, falling objects, hand tools, falls of persons, handling rock, and haulage. The principal causes of accidents resulting in death to employees inside the quarries were falls or slides of rock or overburden, explosives, falls of persons, haulage, and machinery, while accidents resulting fatally to the employees at the outside plants were due mainly to machinery, haulage, falling objects, falls of persons, and burns.

Portable Belt Conveyors

The George Haiss Manufacturing Company has issued a new catalog describing Haiss portable belt conveyors. The Haiss machines are furnished in several types, namely: the standard conveyor, which is a wheel mounted machine designed to be moved by hand; the self propelled belt coveyor, which is supported on a four wheel chassis unit with suitable steering gear; the bail mounted conveyor, which is furnished for suspension from a derrick arm or other support; etc. The machines are furnished with either the flat or troughing belt. The catalog is profusely illustrated and contains detailed and general specifications of the Haiss machines.

Lime Plant Utilizes Waste Product

By F. A. Westbrook

SEVENTY years or more ago the Fonda Lime Kilns at Swanton Junction, Vermont, between St. Albans and Swanton, were started in operation. As might be expected of any operation with such a length of service, considerable steam driven equipment still remains. This operation has always been profitable although conservatively managed. New electrically driven machinery is, however, being added from time to time. Many features of this plant are unusually efficient. The waste product is utilized to a marked degree, and the production of crushed stone for various purposes has been taken up with a view to increasing efficiency.

Kilns

The three kilns are of the wood burning type,—wood and coal are actually used,—with forced draft. The draft is secured by means of a fan driven by a 1.5 h.p. Century motor or a 5 h.p. Frost-King gas engine which has been installed for emergency service. Such a precaution is, of course, very necessary because in this country of severe winters electrical power fails at times, with disastrous results to the production of lime if there is no other source of power for the draft. The illustrations show the appearance of the plant from the outside and the bottom of one of the kilns in the interior, together with the flue for the forced draft.

Piece Work

Each kiln is tended by two firemen, each working on twelve hour shifts, who are paid on a piece work basis. The men do the firing, draw the lime, load it into barrels, head them and then load them into box cars. The form on which the record is kept is illustrated. The amounts of lime drawn morning and night are kept in separate columns and the total for the day added up in another column as shown. The dark lime, or incompletely burned pieces, are also recorded and credited to the production of the kiln, for a certain amount of this is unavoidable and not the fault of the men. The total production for the week is evenly divided between the two men, which has been found to be the fairest system to follow because of unavoidable variations between night and morning results. By securing team work between the two men the largest output is sure to follow. A box car on a freight siding from the Central Vermont Railway on the side of the building adjacent to the drawing floor is shown in one of the illustrations.

The dark pieces of partially burned stone are dumped out of doors where they air slack and gradually crumble. This material is periodically gathered up and sold for agricultural purposes.

Charging the Kilns

The side of the plant from which the kilns are charged also has its railroad spur over which coal and wood are delivered. Waste material has been piled up on the higher ground on this side so that the dump cars coming from the quarry loaded with

Storage of Surplus Stone for Kilns.

Incline from Bottom of Quarry.

stone for the kilns may be hauled over practically level tracks across the bridge shown in one of the illustrations directly to the top of the kilns. It will be seen that the tracks extend along the top so that all the kilns may be reached.

Quarry

The quarry is a deep one having a breast about 80 feet high at one end. An idea of this may be obtained from the illustration which also shows the incline leading up to the top. Cars are hauled up this by means of a Roebling cable operated by a steam hoist which has been in service a great many years. It will be seen that the hoister house is located about half way up. The water for the boiler is obtained from the well of the quarry.

Drilling is done by means of Sullivan steam drills. Blasts vary in amount from 125 to 400 tons and are set off at rather frequent intervals. Large amounts of stone are kept in reserve at all times at the top of the quarry along both sides of the track leading to the tops of the kilns. This of course enables the kilns to be operated if weather conditions or labor trouble should stop the operation of the quarry. A supply sufficient for six to eight weeks is kept on hand.

Subsiding Operations

Of course during the many years that the Fonda Lime Kilns have been worked there has been an enormous accumulation of waste material not suitable for burning but nevertheless valuable for various purposes. The extent of this accumulation is shown to some degree in Figure 8. This waste, of course, represents a large expenditure without returns which will continually increase unless some use is found for it. Consequently it is very good business to develop an

Bridge for Charging Kiln and Railroad Siding for Receiving Fuel.

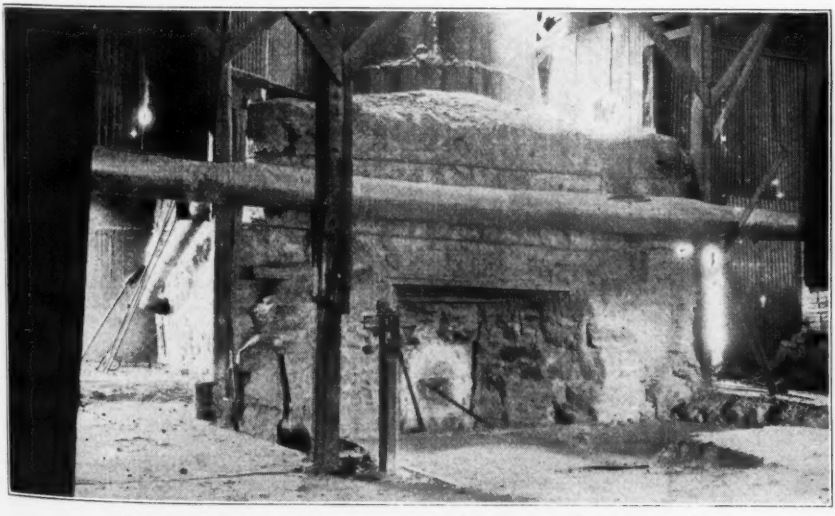
outlet for it, and this is exactly what is now being done.

One source of waste is stone which is so small that it cannot be put into the kilns because it clogs them. A crushing plant has therefore been installed to make this suitable for road work, for which it is of course excellent. The plant consists of a Reliance crusher and elevator shown to the right in Figure 9 and a Montreal screen over a series of bins. The whole outfit is stationed along a railroad spur so that freight cars may be loaded from the chutes.

Fertilizer is another by-product. This is made from the waste material which is not suitable for burning because of impurities. The Jeffrey crusher is used for this purpose. This crusher is located under a shed adjacent to the source of supply, in other words the waste material dump, and it is equipped with an elevator which carries the crushed stone to the top of a chute from which bags or wheel barrows may be loaded. Shipments are made both in bags and in bulk. The railroad siding is also close to this machine so that loading freight cars is both convenient and efficient. A rather ingenious and certainly unusual temporary drive has been arranged for this machine. The whole installation is new and it was desirable to begin operation of the crusher before an electric motor could be obtained. Consequently a 20 h.p. International tractor was borrowed, or hired, from a farmer in the neighborhood to run it temporarily.

Crusher for Making Fertilizer from Waste.

Under the same shed with the Jeffrey crusher for making fertilizer is an O.B. Wise pulverizer for making chicken feed. This is also equipped with an elevator which drops the pulverized stone into a chute leading into a bin. This material is drawn from the bin through another chute which



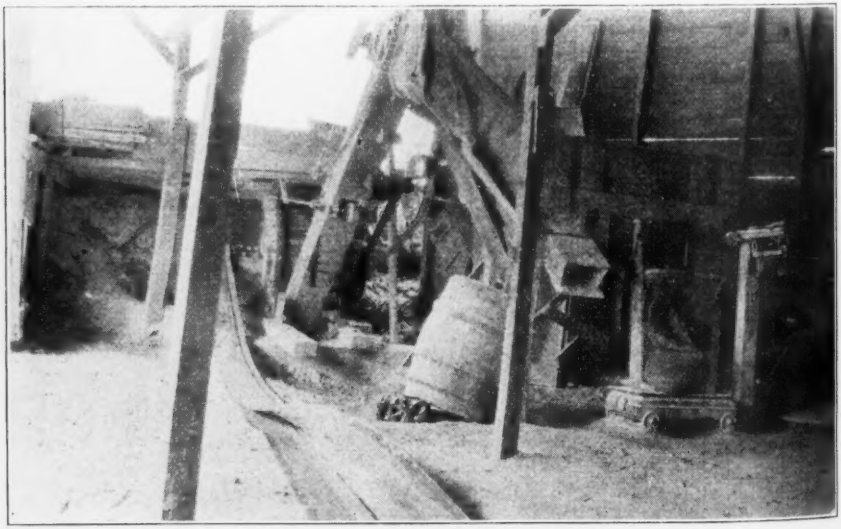
Interior Showing Base of Kilns and Flues for Forced Draft.

Outside of Plant.

is so arranged that bags resting on scales may be filled from it. There is a third chute to the left which can be used for filling wheel barrows when bulk shipments are called for. The installation of this outfit is complete with electric drive consisting of a 35 h.p., 220 volt, General Electric induction motor with Western Electric starting compensator. The same kind of waste material as for fertilizer is being used in this case.

These three subsidiary operations to the making of lime are taking care of all current waste and are gradually using up past accumulations. Of course it will take many years before there can be any shortage of this kind of material.

Any profit which can be made above the cost of crushing and handling for shipment is just so much gain which can be applied either to reducing the price of the lime when competition is severe or to creating a separate source of revenue.



Pulverizing Plant for Making Chicken Feed from Waste.

Employee's Quarters

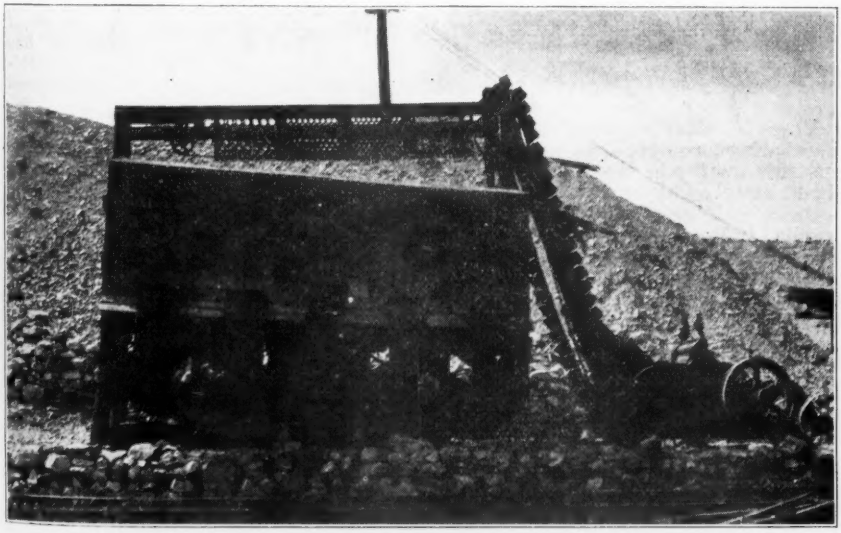
A rather unusual feature for a lime burning operation is the fact that the Fonda Lime Kilns provides living quarters for its employees, or at least some of them. Immediately adjacent to the kilns are accommodations for 19 families which are rented for the nominal sum of $2.45 per week, including fire wood. There is also space available for vegetable gardens. In addition to this the company maintains a store where goods may be purchased at cost. For an industry such as this where some of the help works on twelve hour shifts for seven days a week and which, furthermore, is situated in the open country several miles from the nearest village with practically no transit facilities, this seems to be a very practical arrangement.

It is worthy of note that the old part of the plant having to do with the quarrying and burning of lime utilizes steam power exclusively with the exception of one small electrically driven fan for the forced draft—which, in fact, is a comparatively new feature. All the new part of the plant for crushing stone for the various purposes described is, or will be, electrically driven. This seems to be the logical tendency of the conservatively managed operations and doubtless has much in its favor from the standpoint of keeping down the investment. It certainly seems to be the fact that this operation—together with others which have been observed to follow the same policy—is on a sound financial footing and doing a reasonably profitable business. Just where the line should be drawn depends on local conditions and can only be determined by careful study and close contact with the individual plant.

Directory Consolidation

MacRae's Blue Book Company, having acquired control of Hendricks Commercial Register, will in the next edition issue a general directory, known as "MacRae's Blue Book, Consolidated with Hendricks Commercial Register." The consolidated publication will cover not only the steam and electric railroad field but also the industries of America, public utilities, chamber of commerce, etc.

On the advisory board of the new publication appear such names as Dr. H. M. Raymond, President, Armour Institute of Technology; B. B. Ayers, Advertising Manager, American Steel and Wire Company; G. H. Porter, General Sales Manager, Western Electric Company; Carl Hamilton, Advertising Manager, Weyerhauser Forest Products; F. E. Paradis, formerly Construction Engineer, N. Y. C. R.R. lines; C. W. Kelly, Secretary, National Railway Appliances Association; E. F. DuBrul, General Manager, National Machine Tool Builder's Association.



Crushing and Screening Plant for Making Road Material from Waste.

Virgil Marani

One of the foremost authorities on gypsum, Virgil Marani, died suddenly at his home on November 2, 1925, of brain hemorrhage. Mr. Marani was regarded with friendship and admiration throughout the non-metallic mineral industries. He was one of the most informed of the authorities on gypsum in all its phases.

Virgil Marani.

Virgil G. Marani, for many years Chief Engineer of The Gypsum Industries, with headquarters at 844 Rush Street, Chicago, was born July 4, 1868 at Reggio, in the Province of Emilia, Italy. He was left an orphan when very young and for this reason was transferred to Edinborough, Scotland, where with his two brothers, he received a common school education and was taught to forget his native tongue. At the age of eleven, young Marani, displaying an independence characteristic of his birth date, ran away from school, was caught and by way of discipline and punishment was put upon a naval school ship known as Her Majesty's Ship Conway, located at Liverpool, England. For two years he served on this ship and then was given an honorary discharge because he was considered to be of insufficient physical strength to complete the naval course. Determined to build up his physical strength and to see the world, the thirteen year old boy shipped on a full rigged sailing ship which was at that time one of the largest in the world, and began a career as a sailor which lasted until he was twenty-one years of age. In that time, he served on sailing vessels and steamships, circumnavigated the globe twice, sailed around Cape Horn and the Cape of Good Hope many times.

At twenty-one Mr. Marani inherited his share of what was left of his mother's estate and had the good judgment and ambition to use this sum to pay his way through high school and university. Within four years he completed both high school and university work, graduating from Toronto University in 1893.

Within a year after his graduation from Toronto, Mr. Marani had landed in Cleveland and was employed in the city engineer's office successively as assistant city draftsman, chief draftsman, and inspector and engineer of sanitation. In 1896 he became Engineer of Construction for the Cleveland Gas Light & Coke Company, holding this position for more than ten years. Serving as a private consultant and also under the name of "Marani and Moore," Mr. Marani has designed and erected all types of buildings from residences to manufacturing, office and similar buildings. He was Engineering Superintendent of the Cuyahoga County Court House, a five million dollar monumental structure and following completion of this building became Building Commissioner of Cleveland, Ohio. After serving as Consulting Engineer for the National Fireproofing Company of Pittsburgh, Mr. Marani became Consulting Engineer for the United States Gypsum Company, leaving this company to take up service during the war as representative of the War Service Committee on Gypsum. Since 1918 Mr. Marani had been Chief Engineer of The Gypsum Industries. His loss will be keenly felt by every interest with which he was associated.

Retarders for Portland Cement

By Ernest E. Berger*

Part II

The first part of this article appeared in the November 1st number of Pit and Quarry. The author in part one discussed the work of other investigators, the preparation of cement and retarder samples, the method of proportioning and mixing the retarder, the determination of time of set, the determination of tensile strength and the relation between the chemical composition of clinker and its reaction with different forms of retarders.—Editor.

Effect of Different Retarders on Consistency and Plasticity of Clinker

CLINKER itself has a low plasticity, and a large amount of mixing water is required before a normal consistency can be obtained. If used in this form it would be impossible to remove all the air pockets from the mortar, and a very weak and unsatisfactory cement would result. The effect of different forms of retarders on the consistency of the clinker is illustrated in Figure 2. All the samples are represented in this graph. The lines are irregular because of the individual properties of each clinker, but in this instance as well as in every other where retarders are compared, the relation of one curve to the other is so consistent as to leave no doubt concerning which of the forms is the most desirable.

It will be noted at once that the plaster of Paris increases the plasticity more than any other form of calcium sulphate. The amount of water required is independent of the percentage of plaster used, within experimental error, as long as this percentage is kept within the limits necessary for proper retardation. Another notable feature in the action of plaster of Paris is the fact that it is just as effective when mixed with gypsum or anhydrite as when used alone, regardless of the fact that neither of the latter forms are as efficient for increasing the plasticity. Therefore, as long as the plaster makes up 50 per cent of the SO_3 in the retarder, it is still possible to use the minimum amount of mixing water. No tests were made with mixtures containing smaller amounts of plaster so that it is not known whether this could be carried further.

The gypsum curve (Figure 2) remains above the plaster curve in all cases except in samples Numbers 1, 7 and 11, where the clinker itself is quite plastic, and this property is affected very little by any form of calcium sulphate. However, there is no doubt that gypsum does have some effect on the consistency of the clinker. Neither is there any doubt that this effect is not identical with that produced by plaser of Paris.

The cement containing anhydrite requires even more mixing water than when gypsum is used; in fact, it either approaches or is equal to the amount required for the clinker itself. The greatest difference is noted with sample Number 15, but this may be accounted for by the fact that the tests on the clinker were made with parts of a sample which had been ground separately.

Therefore, when any form of calcium sulphate increases the plasticity of cement clinker, plaster of Paris is the most efficient, and it is necessary that some of the retarder be present in this form if the most plastic cement is to be obtained.

Effect of Different Forms of Calcium Sulphate on the Time of Set of Portland Cement Clinker

It is a more or less common opinion that Portland cement clinker itself is always quick setting; however, a study of Figure 3b will show that some types of clinker are slow setting when no retarder is added. A general idea of the effect of each retarder may be obtained from a study of the curves 3a and 3b. The ordinate on Figure 3a refers to the per cent SO_3 added either as plaster gypsum or anhydrite, and does not include the SO_3 which is already present in the clinker and apparently has little or no effect on the reaction.

Plaster of Paris was the first compound to be used as a retarder in Portland cement, but it was soon discovered that gypsum could also be used if it was mixed with the clinker in the tube mill, and because of the great saving in cost, the utilization of gypsum was soon made universal.

*Assistant chemist, Bureau of Mines, Department of Commerce.

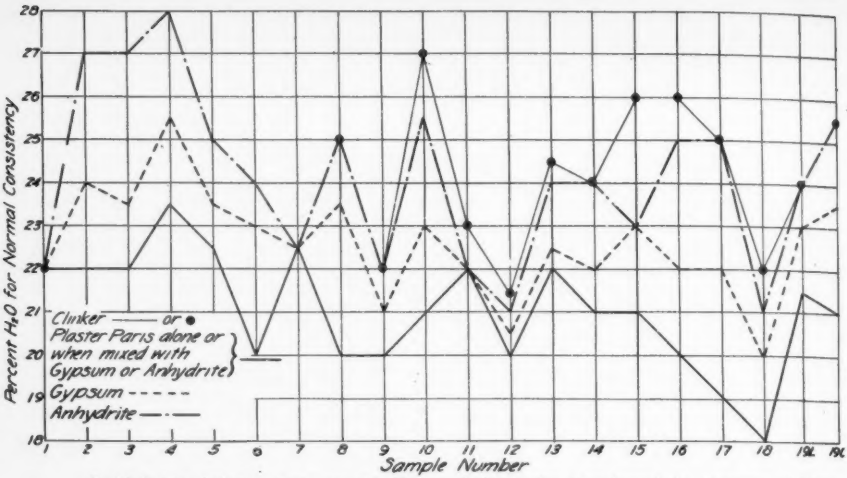


Fig. No. 2. The Relation Between the Form of Retarder Used and the Amount of Water Required for Normal Consistency.

However, on account of the possibility of plaster of Paris ($caSO_4.\frac{1}{2}H_2O$) being formed during the grinding of gypsum in the tube mill, it was thought desirable to study its effect on the clinker as thoroughly as that of any other retarder.

One outstanding feature is the small amount of plaster of Paris which is required for proper retardation. One may conclude that this is easily accounted for by the fact that the samples were ground in the laboratory and the per cent of fine material was much less than would have been obtained in the mill. However, Numbers 19L and 19C are as nearly identical as could be obtained in commercial practice, and No. 19C which was ground in a large compeb mill at one of the plants requires a smaller percentage of SO_3 than Number 19L ground in the laboratory.

The permissible variation in the

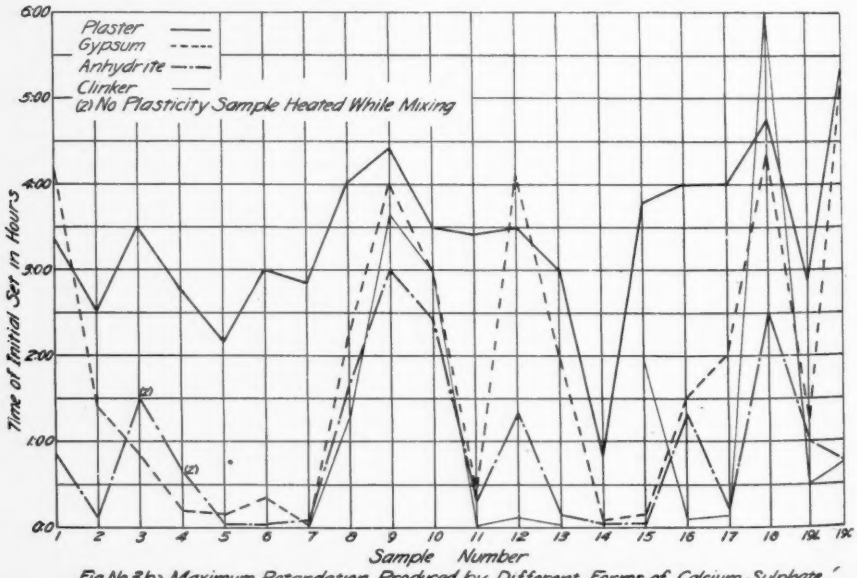


Fig. No. 3b. Maximum Retardation Produced by Different Forms of Calcium Sulphate Within the Maximum SO_3 Content of 2% and its Relation to the Time of Set of the Clinker itself.

SO_3 content is generally quite small when plaster is used. In most instances the cement becomes quick setting again before the total SO_3 content reaches 2 per cent, and sometimes, as in sample Number 11, before it reaches 1.0 per cent. This latter condition will probably account for the opinion of some that plaster of Paris alone will accelerate and not retard the time of set of cement, but a study of Figure 3b will show that it is the most effective retarder if the proper percentage is used; in fact, it is the only one of the three forms of calcium sulphate which is certain to be effective as long as the maximum SO_3 content remains within the 2 per cent limit. As regards strength, however, as will be noted later, there is some advantage in using a type of retarder which will permit a larger percentage of SO_3 since the strongest cement is obtained only when it contains approximately 2 per cent of this compound.

The writer has been unable to find any article in the literature which does not make the statement that gypsum as a retarder is just as effective as plaster of Paris. Perin was unable to note any difference between the action of the two forms as long as the equivalent amounts of SO_3 were used. Meade performed some tests on one clinker in order to see if there was any ground for the opinion that it was necessary for the gypsum to be calcined before it really would act as a retarder, for the clinker used both forms of the sulphate were equally effective. However, the plaster was found to have an accelerating action when more than 2 per cent was present. Eckel goes still further and states that an argument based on the relative merits of gypsum and plaster is fallacious because neither form has any effect until the mixture is gauged with water, at which time the plaster will immediately be reconverted into gypsum and would react as such. However, no account is taken of the possibility that the tendency of plaster of Paris to combine with some constituent in the cement might be considerably greater than its tendency to combine with water and consequently there would be little possibility for the formation of gypsum. Unfortunately there are no data available which will settle this question, but the marked distinction between the action of cement retarded with plaster of Paris and that retarded with gypsum shows that there is considerable justification for believing that the plaster will react with the clinker unchanged. If so, there also is evidence to show that the more marked action of plaster may be accounted for by its greater chemical activity, for according to the calculations of Marignac and LeChatelier its solubility is five to seven times as great as that of gypsum.

The favorable results with gypsum noted above may be accounted for in two ways. First, the general method of mixing the samples is to grind the gypsum and clinker together in a ball mill. Even though the laboratory ball mill is too small to develop even a moderate temperature, there may be considerable dehydration caused by the grinding process alone; in fact, such results were noted when the gypsum was being ground separately. Second, a fairly high percentage of SO_3 is usually used in the tests and consequently the results obtained with gypsum would compare more favorably with those obtained by the use of plaster of Paris.

In general, the opinions of chemists at Portland cement plants seem to be based on the action of their own clinker, so that answers both pro and con have been received from this source. A glance at Figure 3a and 3b will show that such variation of opinion is thoroughly justified. For instance with sample number 12, gypsum is equally as efficient as plaster; with samples number 1, 9, 18 and 19C the retardation is satisfactory but a larger percentage of SO_3 is required than when plaster is used, while with the other samples it is either inefficient or can not be used at all. The blank spaces in the gypsum curve of Figure 3a shows that the addition of gypsum up to a SO_3 content of 2 per cent would not retard these samples the minimum time of one hour. Another important difference between the action of gypsum and plaster is that larger percentages of gypsum do not seem to produce a quick setting cement.

This action of gypsum, as such, points out three important questions, and it would be well if there were enough data to answer them. First, since plaster will always retard the clinker and gypsum as such may not, unless more than 2 per cent SO_3 is added, is there not always some of the gypsum calcined to plaster while being ground with the clinker in the tube mill? (Temperatures of tube

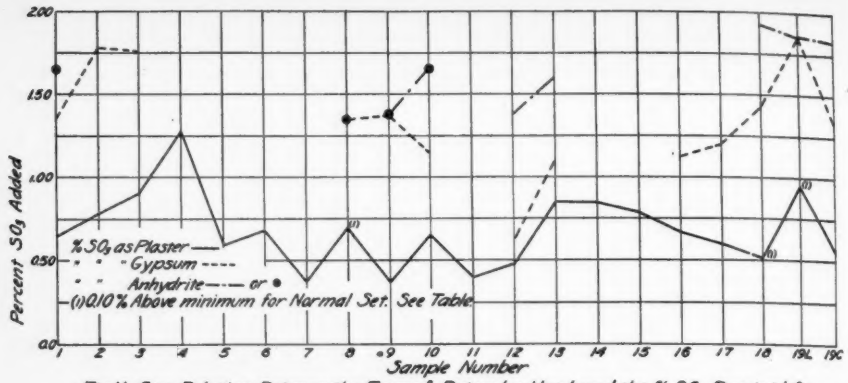


Fig. No. 3a — Relation Between the Form of Retarder Used and the % SO_3 Required for Proper Retardation.
Breaks in the Two Upper Curves Show that the Addition of Gypsum or Anhydrite up to a Total SO_3 Content of 20 % Will Not Retard these Samples the Minimum Time of One Hour.

mills noted vary from 122° to 180° C). Second, since the SO_3 content of cement is usually carried between 1.50 and 2.00 per cent, and as this amount is often sufficient to produce a quick setting cement, if all were present as plaster, does not part of the gypsum remain unchanged even after being ground with the clinker?

An attempt was made to obtain some information on this subject, and a sample of mill ground clinker was obtained for these tests; number 19C is a mill ground clinker and number 19 is a sample of cement made from this same clinker. A determination was made of the minimum SO_3 plaster which would properly retard 19C and then additions of 19C were made to number 19 until the SO_3 content of the latter was reduced sufficiently for the cement to have a flash set. It was hoped that the difference in the SO_3 content of these two samples at this point would give some idea of the amount of gypsum in number 19 which had been calcined, and it will be noted in the table that the extreme minimum SO_3 for 19C is slightly below that for number 19. This difference might have been more pronounced if a clinker like number 6 had been used which was not affected by a small percentage of gypsum; but since number 19C was retarded by the use of 1.50 per cent SO_3 as gypsum, it is impos-

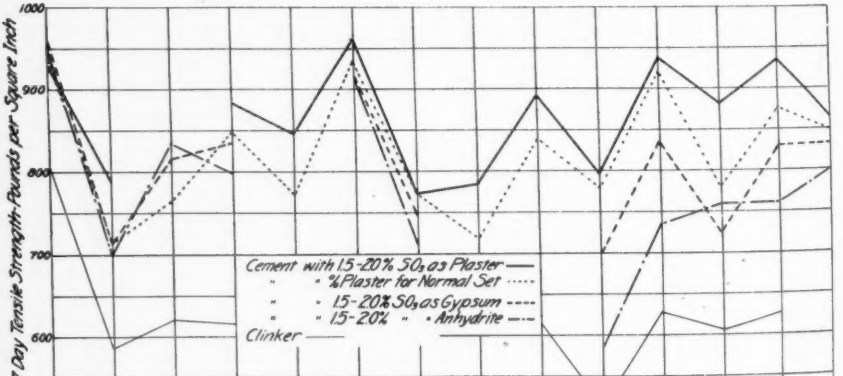


Fig. No. 5 — The Effect of Different Retarders on the Tensile Strength of Cement. Curves Represent the Average Strength of all Briquettes Containing SO_3 Specified in the Legend.

	No1 SO3=.035 HI=.144 Fineness 85.3%-200					No2 SO3=.022 HI=.042 Fineness 87.0%-200					No3 SO3=.024 HI=.042 Fineness 80%-200					No4 SO3=.014 HI=.042 Fineness 82.0%-200					No5 SO3=.010 HI=.045 Fineness 91.8%-200					No6 SO3=.042 HI=.046 Fineness 77.6%-200					No7 SO3=.013 HI=.052 Fineness 93.5%-200				
	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2
	64.45	1.05	4.80	4.04	23.20	64.33	3.60	6.57	3.43	20.05	63.64	2.70	6.25	2.00	21.57	64.01	n.d.	7.11	3.11	23.21	64.32	4.10	5.85	2.70	23.25	63.0	3.00	6.36	3.25	21.72	63.54	0.77	5.09	0.42	27.02

Total SO3	SO3 Soluble	% H2O	Set Initial	Set Final	7dy Compressive Strength	SO3 Soluble	% H2O	Set Initial	Set Final	7dy Compressive Strength	SO3 Soluble	% H2O	Set Initial	Set Final	7dy Compressive Strength	SO3 Soluble	% H2O	Set Initial	Set Final	7dy Compressive Strength	SO3 Soluble	% H2O	Set Initial	Set Final	7dy Compressive Strength	SO3 Soluble	% H2O	Set Initial	Set Final	7dy Compressive Strength	SO3 Soluble	% H2O	Set Initial	Set Final	7dy Compressive Strength
Control		.22	0.05	2.00	8.01																										.03	2.00		
0.25																																			
0.30																															.17	2.25	0.07	0.13	
0.40																															.27	"	0.56	0.50	5.68	
0.50																															.37	"	2.50	3.10	5.95	
0.60																																				
0.65																					.55	2.25	0.03	1.30							.52	"	2.45	4.30		
0.70	.40	.22																			.60	"	2.10	5.00											
0.75	.40	.22	0.17	3.45																	.65	"	1.35	4.00							.62	"	2.50	6.30		
0.85																																				
0.90																.76	.24	Flash			.80	"	1.35	4.15											
1.00	.65	.22	3.20	5.40	9.68	0.78	.22	2.30	5.00		.76	.24	Flash								.40	"	"	3.40		.52	.21	Flash			.87	"	2.30	5.30		
1.15											.91	.22	3.20	6.00		1.01	.24	Flash								.67	.205	2.40	2.50	7.41					
1.25																					1.15	"	1.25	"		.78	"	2.90	4.15	7.31	1.12	"	0.30	4.45		
1.35											1.11	"	"	"		1.21	2.35	0.03	0.10							.82	.20	2.24	6.00						
1.50	1.15	.22	(1) 2.00	5.00	9.42	1.36	.22	2.20	5.00		1.26	"	3.30	"		1.28 1.36	Ok 2.35	3.30	5.45		1.40	"	1.05	3.00		1.02	"	0.24	6.00		1.37	"	0.30	4.30		
1.75	1.40	"	(1) 1.45	"	9.19	1.53	"	1.40	4.00		1.51	"	2.40	5.00	8.63						1.65	"	0.20	"												
2.00	1.65	"	0.25	4.10		1.70	"	1.00	3.30		1.76	"	(1) 2.10	4.30		1.95	"	2.45	4.30																	
2.50																																				
0.75																																				
1.00	0.85	.23	0.09	0.45																																
1.50	1.15	.22	0.35	"	9.33											1.36	2.55	0.10	3.30							1.02	.23	0.20	3.00						
1.75	1.40	"	3.30	7.30		1.53	2.45	0.55	5.30		1.51	.24	0.25	3.40																						
2.00	1.65	"	4.10	7.50	9.95	1.78	.24	1.25	"		1.76	2.35	0.50	4.00		1.86	"	0.12	"		1.90	2.35	0.10	4.25		1.52	"	0.03	1.30		1.87	2.25	0.03	3.20		
1.00	0.85	.26	0.02	3.50																																
1.50	1.15	2.55	0.04	4.30							1.26	.29	(2) 1.15	4.30																	1.57	2.25	0.04	0.20		
1.75	1.40	.22	0.40	5.20	9.59	1.53	.27	0.04	2.50		1.51	.28	(2) 1.00	5.00	6.40	1.61	.29	0.35	3.00																	
2.00	1.65	"	0.50	6.30	9.31	1.65	"	0.06	3.50		1.70	.27	1.30	4.00		1.86	.28	(2) 0.40	3.30		1.90	.25	0.03	2.50		1.52	.24	0.08	1.30		1.87	"	0.04	0.30		
2.50																																				
0.50																															14P 14A	2.25	0.08	0.13		
0.75																															31P 31A	"	2.10	4.20	5.71	
0.95																															41P 41A	"	2.10	4.40		
1.00	33P 33A	.22	4.00	6.20																																
1.10																					38P 50A	2.25	0.50	5.00											
1.25																					50P 50A	"	3.00	"											
1.35																													Flash							
1.50	38P 50A	.22	4.10	5.40			.22	Flash													70P 70A	"	2.05	3.35		51P 51A	.20	0.06	0.20						
1.75	70P 70A	"	3.20	6.00		77P 77A	.22	2.30	5.00		75P 75A	Flash				81P 81A		Flash			63P 63A	"	2.05	3.40		63P 63A	"	Quick Set							
1.00											70P 70A	.22	3.50	7.00												66P 66A	"	4.00	7.00	7.47				
2.00						89P 89A	"	2.30	5.00		84P 84A	.23	3.30	6.30		93P 93A		Flash																			
2.15																101P 101A	.23	3.15	5.40																
1.50																																				
1.75																																				
2.00																																				
1.00																																				
1.25																																				
1.50																																				
1.75																																				
2.00																																				

0.75 Began to set in a few minutes, sometimes enough to stop
1.00 Vicat needle but needle would sink to bottom of pat in less
1.25 than 30 sec. 2. Sample warmed when mixing Plasticity
1.50 low 3. Low Plasticity
1.75 P = SO_3 as Plaster Paris G = SO_3 as Gypsum
2.00 A = SO_3 as Anhydrite HI = Hydraulic Index

No 8	SO₃=0.15 HI=0.46				No 9	SO₃=0.13 HI=0.49				No 10	SO₃=0.35 HI=0.47				No 11	SO₃=0.10 HI=0.46				No 12	SO₃=0.12 HI=0.45				No 13	SO₃=0.90 HI=0.47				No 14	SO₃=0.18 HI=0.51			
Fineness 805%-200					Fineness 869%-200					Fineness 915%-200					Fineness 896%-200					Fineness 830%-200					Fineness 976%-200					Fineness 880%-200				
CaO	MgO	Al₂O₃	Fe₂O₃	SiO₂	CaO	MgO	Al₂O₃	Fe₂O₃	SiO₂	CaO	MgO	Al₂O₃	Fe₂O₃	SiO₂	CaO	MgO	Al₂O₃	Fe₂O₃	SiO₂	CaO	MgO	Al₂O₃	Fe₂O₃	SiO₂	CaO	MgO	Al₂O₃	Fe₂O₃	SiO₂	CaO	MgO	Al₂O₃	Fe₂O₃	SiO₂
6415	330	619	314	2376	6275	374	559	268	2490	6329	285	559	259	1458	6301	290	618	320	2282	6310	465	599	282	2206	6280	259	724	311	2240	6299	312	802	243	2334
%50 Passing	% H_2O	Set Initial	Set Final	7dy Strength	%50 Passing	% H_2O	Set Initial	Set Final	7dy Strength	%50 Passing	% H_2O	Set Initial	Set Final	7dy Strength	%50 Passing	% H_2O	Set Initial	Set Final	7dy Strength	%50 Passing	% H_2O	Set Initial	Set Final	7dy Strength	%50 Passing	% H_2O	Set Initial	Set Final	7dy Strength	%50 Passing	% H_2O	Set Initial	Set Final	7dy Strength
	25	115	900	5080		22	340	640	682		28	300	600	617		23	009	500			215	007	530			245	0	02	005			24	Flash		
															20	22	009	008	740															
						37	20	425	635	706					40	"	325	520	772	38	20	035	200	842											
45	25	Flash																																
																				48		O. K.												
60	20	130	210	645	62	20	425	635		40	25	Quick	Set		65	22	030	510		6	20	330	530	904						69	21	040	105	788
70	O.K.																																	
85	20	400	630	683	87	20	415	630	826	65	21	300	520	807	90	22	025	500	847	88	"	300	500	950						84	21	050	400	
										90	"	330	530	854						113	"	240	500	950						109	"	020	350	778
120	20			743																														
135	21	320	600		137	21	040	600		115	"	330	600	883	140	"	013	400		130	"	017	420	958	60		Flash			134	"	010	415	785
160	Wet 215	135		790																					85	22	200	350	766					
										165	"	030	500	839						188	"	015	405	964	110	"	300	430	780	184		006		810
																									160	"	310	530	810					
																				83	205	325	700	864										
																				88	"	405	610	946										
135	235	145	500	690	137	21	350	700		115	29	300	550		140	"	026	645		138	"	"	"	898	80	225	006			134	22	Flash		
																				108	"	"	620	850										
185	"	215	545	739	187	"	(10) 400	830	815	165	"	"	"	936	190	"	020	"							110	225	200	520	746	184	"	Flash		
																				88	21	010	400	819										
115	25	110	350	644	137	22	240	700		115	255	010	200		140	22	005	455		138	"	120		929										
185	"	140	420	752	187	"	(11) 300	800	835	165	"	225	500	797	190	"	018	540		188	"	120	610	905	110	24	010	330	714	184	24	Flash		
																									160	"	200	420	778					
															70P 70A	22	003	006	747															
															39P 39A	"	320	600		31P 31A	205	340	700											
43P 43A	25	Flash								22A	21	Quick	Set		43P 43A	22	330	630	860	44P 44A	20	350	600	933						41P 42A	21	Flash		
										45 45	"	"	"																					
80P 80A	20	410	600	872	81P 81A	20	400	700	875																					87P 87A	21	012 120	430 490	765
										38P 38A	"	115	615	866	70P 70A	22	375	530	873	69P 69A	"	320	510	952			Flash							
										70P 70A	"	400	600							87P 87A	"	330	540	976										
										89P 89A	"	420		842						94P 94A	"	330	515	929	33P 33A	22	100	300	765	98P 98A	21	020	410	775
																									80P 80A	(15 Sec Final) "	310	500	825					
																				82P 82A	20	350	700	897										
																				97P 91A	20	320	620	928										
																				132P 056A	20	230	600	970	77P 33A	22	120	300	770	120P 056A		015	400	701
																				31P 31G	20	440	700	888										
															43P 43A	22	420	600	885	45P 45G	20	410	610	976						42P 42G	21	100	430	775
															70P 70G	"	400	550	867	70P 70G	"	400	610	965	90P 90G	22	010	030		87P 87G	21	125	540	783
																									43P 43G	"	030	400	718					
																				94P 94G		330	540	908	55P 55A	"	110	340	776	92P 92G		115	400	735

No15 SO₃-021 HI-044 Fineness 830%-200					No16 SO₃-038 HI-044 Fineness 85.0%-200					No17 SO₃-030 HI-043 Fineness 89.0%-200					No18 SO₃-008 HI-048 Fineness 730%-200					No19L SO₃-015 H.I-047 Fineness 845%-200					No19C SO₃-016 Mill Ground Fineness 850%-200					No19 SO₃-2.35 Mill Grd. Cem. Fineness 81.0%-200				
CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	SiO_2										
6405	246	809	335	2047	6482	158	738	412	2140	6534	217	636	248	2164	6519	ND	715	215	2400	650	N.D	770	293	2271										
% SO_3 Added	% H_2O	Set Initial	Set Final	7dy Tensile Neat	% SO_3 Added	% H_2O	Set Initial	Set Final	7dy Tensile Neat	% SO_3 Added	% H_2O	Set Initial	Set Final	7dy Tensile Neat	% SO_3 Added	% H_2O	Set Initial	Set Final	7dy Tensile Neat	% SO_3 Added	% H_2O	Set Initial	Set Final	7dy Tensile Neat	% SO_3 Added	% H_2O	Set Initial	Set Final	7dy Tensile Neat	% SO_3	% H_2O	Set Initial	Set Final	7dy Tensile Neat
	26	200	500	616		26	007	500	513		23	010	800	629		22	600	400	606		24	020	700	625		255	045	630						
															.42	18	110	115																
																									.42	21	200	245			22	Flash		
54	21	Flash								45	21	Flash			67	·	400	510	724						57	·	500	640	799		"	450	700	845
64	·	011	037																															
										.60	19	300	340							.75	215	Flash												
79	·	345	515	797	62	20	020	023	689	70	-	400	520	886	92	18	445	720	790	.85	·	100	110	830	82	·	520	730	886		225	510	710	866
					77	·	320	350												100		OK												
·04	·			829	87	·			708											1.10	215	250	520	906							·	430	·	886
29		037	5:00	892	112	-	400	715	752	120	-	130	530	903	142	·	(115) 4.30	730	825	135	·	220	500	918	132	·			863					
54	·	020	430		137	-	255	600	830																						·	420	700	920
79	·	014	340		162	·	230	520	812	170	·	010	500	973	192	·	015	400	939	185	·	130	450	950						(Total 215)	23	350	·	
																														(Total 235)	235	220	620	864
										70	23	040	140	764											0.82	235	020	1:00						
29	23	007	405		112	22	130	310	649	120	·	200	400	829	142	20	320	610	723	135	23	032	330		132	235	315	700	788					
54	·	·	420																															
79	·	010	·		162	·	145	600	741	170	·	145	530	849	192	"	420	720	726	185	·	115	405	831	182	"	510	800	832					
79	23	Flash																																
29	·	001/2	100												142	21	050	300	743	135	24	050	320	740	132	255	020	345						
79	·	002	100		162	25	120	700	586	170	25	013	400	735	192	·	230	530	772	185	·	100	330	778	182	·	046	435	800					
																				235	25	050	325	926										
																															22	Flash		
										33P 33A	21	Flash			46P 46A	18	430	650	841						41P 41A	21	450	730	939		22	420	720	697
52P 52A	21	Flash																													·	430	730	
55P 55A	·	315	530	880	38P 56A	20	Flash			60P .60A	19	400	630	924	71P 71A	18	400	630	897	68P 68A	215	Flash			.66P .66A	21	350	700	933		·	430	700	810
77P 77A	·	330	600	920	68P 68A	·	330	600	832											80P .80A	"	315	605	920							·			888
					81P 81A	20	315	520	845	85P 85A	·	400	640	917	96P 96A	"	330	615	897	93P 93A	·	240	430	928							·	410		
77P 32A	21	250	450	835																81P .54A	215	Flash												
92P 62A	·	300		865																96P 64A	·	315	515	940										
																				111P 0.78A	"	245	445	947										
										49P 21A	19	025	030	835	64P 28A	18	400	610	838															
					61P 26A	20	300	530	755																									
[illegible]	21	300	430	811	78P 34A	·	·	·	774	84P 36A	·	350	610	900	99P 42A	"	340	615	886	95P .41A	215	330	550	895										
[illegible]	·	240	440	865	93P 40A	·	310	·	786																									
					119P 049A	·	315	520	853	119P 051A	·	310	610	924	134P 058A	·	300	600	931	130P 056A	·	310	450	935										
										35P 356	19	Flash			46P 466	18	400	630	842															
					44P 446	20	300	550	726																									
					56P 566	·	310	530	802	60P 606	·	400	620	907	71P 716	·	510	700	883															
					67P 676	·	·	·	818																									
					81P 816	·	330	540	831	85P 856	·	510	630	984	96P 966	·	455	700	814															

sible to draw any definite conclusions regarding the percentage of gypsum that was calcined. However, the fact that the minimum SO_3 as gypsum is 1.50 per cent when mixed with the clinker (19C) in the laboratory, and only 0.75 per cent when mixed with the same clinker (number 19) in the large tube mill, furnishes quite definite evidence that an appreciable amount of the gypsum is dehydrated during the grinding process.

Still another important question regarding the action of gypsum is,—Will the heat in the fresh ground cement and its great affinity for water continue to dehydrate the gypsum after the cement has been placed in the storage bin? If the latter is true, changes during storage either from a quick set to normal or from a normal to a quick setting cement could be explained on this basis. If the total SO_3 content were great enough to retard the clinker when all were present as plaster, but not enough to retard it if some were present as gypsum, then the further dehydration of gypsum during storage would produce a normal set. On the other hand, if there was a sufficient amount of plaster present when the cement was first ground, then the further dehydration of the gypsum might bring the per cent of plaster up to the point where the cement would again be quick setting. This is quite possible as the SO_3 content of Portland cement is usually between 1.50 and 2.0 per cent, and the table shows that if this were all present as plaster of Paris there are many cases where the cement would be quick setting.

Here again different investigations point to quite diverse conclusions. Gadd has found that cement to which gypsum had been added did not change its setting time in six months when stored in an air-tight container, and a German Portland cement association report shows that after a year's storage a cement to which 2.5 per cent of gypsum had been added showed no appreciable change in time of set. Both of the above experiments were conducted with samples of cement, not clinker. The material was cool, and the added gypsum would neither be as fine nor as intimately mixed with the clinker as if it had been ground commercially, consequently the results are not conclusive.

On the other hand Gadd has concluded that Portland cement is capable of abstracting water from salts containing water of crystallization with which it lies in contact for some weeks, and one of the plant chemists has found that gypsum will not retard one clinker when the two are first mixed in a mechanical mixer; but after the mixture is allowed to stand for a few weeks, it will have a normal set.

Clearly, no definite conclusions can be drawn regarding the action of the cement clinker on the gypsum during storage, and it seems logical to assume that the reason for change in time of set could be found here rather than to assume that some change takes place in the clinker itself. It is a well known fact that both carbon dioxide and water have a marked effect on the setting time of cement, but it seems improbable that either of these would penetrate deeply enough from the atmosphere into the bin of cement to cause any effect at least within the first few weeks. Such tests on cement in bin storage are now being conducted at the Lewis Institute Laboratory, and it is hoped that the results will be available in the near future.

It is true that the larger cement companies at least have very little trouble with quick setting cement at this time; however, such irregularities do sometimes occur and according to Saben and Witt a quick setting cement may either become normal during storage or a normal cement may become quick setting.

The value of anhydrite as a retarder in Portland cement clinker is also a much debated problem among cement manufacturers, and here again one finds little if any literature which does not put it on an equal basis with plaster and gypsum. The tests of Lewis show that anhydrous calcium sulphate is the best form of retarder, and Meade states that it compares equally well with other forms of calcium sulphate. However, artificial anhydrite was used in both these tests and, as the method of preparation of this material is not given, it is quite possible that it was not burned sufficiently to possess the characteristic properties of natural anhydrite, or it may have even contained a considerable amount of soluble anhydrite.

Results obtained in the bureau investigation are presented graphically in Figures 3a and 3b. First, it will be noted that even when anhydrite can be used a larger proportion of SO_3 is required than for any other form of calcium sulphate; second,

there are breaks in the anhydrite curve (Figure 3a) showing that the anhydrite in many cases can not be used at all when the total SO_3 content is kept below 2 per cent; third, Figure 3b shows that the anhydrite can be used safely as a retarder only when the clinker itself is slow setting. Sample number 16 is the only quick setting clinker that is sufficiently retarded by the use of anhydrite, and even then the initial set is reached in one hour and twenty minutes, and this is too close to the minimum of one hour to be safe. Furthermore, this sample is exceptionally weak and nonplastic. (See Figures 2 and 5.)

It seems quite certain that anhydrite alone would not make an efficient retarder for any of the samples of clinker which have been used in this investigation, but another possibility has been suggested, namely the use of a mixture of gypsum and anhydrite. This phase of the investigation is of great importance since anhydrite is usually found mixed with gypsum in nature.

The first tests seemed to indicate that plaster of Paris is really the form of calcium sulphate that produces the most favorable reaction with Portland cement clinker, and that gypsum as such might have no effect at all; consequently, it was thought advisable to use mixtures of plaster of Paris and anhydrite rather than gypsum and anhydrite as the results obtained with the latter mix, in the laboratory, would often be negative and little information would have been obtained. A mixture identical with that obtained by grinding gypsum and anhydrite with the clinker in the tube mill would have been preferable, but there is no way at present of determining the exact nature of such a mixture. Therefore, it was decided to determine the conditions under which the mixtures could be used as a retarder, then the results of a few commercial tests would determine whether it is economically possible to obtain these conditions in the mill.

Four mixtures in all were tested for their values as retarders: one containing equivalent amounts of SO_3 as plaster and anhydrite; another containing seventy parts of SO_3 as plaster and thirty as anhydrite; two samples were tested with a 60-40 plaster-anhydrite mix, and some tests were run with a mixture containing equivalent parts of SO_3 as plaster and gypsum as the results seem to indicate that this was similar to the conditions obtained commercially.*

There seemed to be no logical reason for assuming that anhydrite should react differently in controlling the time of set of cement clinker when added with plaster, from the way it would act when added alone. Consequently the minimum SO_3 as plaster was determined when added with an equivalent amount of anhydrite, and when this amount was compared with the minimum SO_3 as

*The method used in obtaining the desired per cent of SO_3 was as follows: In order to obtan a SO_3 content 1.75 per cent the SO_3 in the clinker was first substracted from the total then if this were 0.25 per cent, it would leave 1.50 per cent SO_3 to be supplied by the retarder. For a 50-50 plaster-anhydrite mix 0.75 per cent of the SO_3 would be supplied by the plaster, and the other 0.75 per cent by the anhydrite.

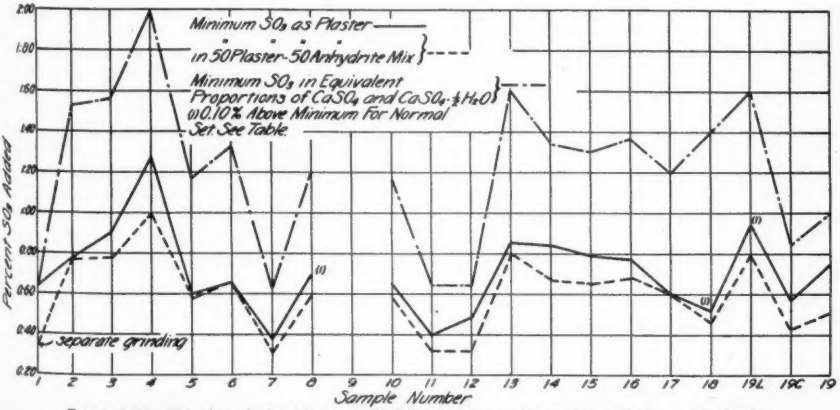


Fig No. 4. The Relation of the Minimum % SO_3 as Plaster When Used With an Equivalent Amount of Anhydrite to the Minimum % SO_3 as Plaster when it is used Alone as the Retarder.

plaster used alone, it was found to be practically the same. Figure 4 illustrates how closely these two curves run together, and it also shows that nearly twice as much retarder is needed when a 50-50 plaster-anhydrite mix is used instead of plaster alone. (The variations in sample number 1 may again be accounted for because of the fact that two separate grindings are represented.) A study of the table (Figure 8) will show that this same relation holds even with the 70-30 mixture which, even though it is richer in the percent SO_3 as plaster of Paris, will not retard the clinker when this percentage falls below the minimum for plaster alone. Therefore, as far as time of set is concerned, the anhydrite in the mixed retarders has very little effect and surely not enough to justify the large increase in the amount of retarder which is necessary. A study of the tensile strength tests will, however, establish a more favorable attitude toward the use of the mixture containing anhydrite.

It was not possible to run very many tests using a mixture of plaster of Paris and gypsum as a retarder, but as stated above the data seem to indicate that this is actually what is obtained commercially. Therefore, it is desirable to be able to compare it with anhydrite mix in order to see if either of the two have any specific advantages. A 50-50 plaster-gypsum mixture was used. It was found that the retardation was equivalent to that obtained by the use of any other form of retarder. There were not enough tests run to obtain data regarding the amount of SO_3 required for proper retardation, but for sample number 17, at least, it is greater than when the plaster alone is used.

The mixed retarders have two important advantages: first, maximum plasticity and proper retardation are obtained without the possibility of producing a quick-setting cement with a SO_3 content below 2 per cent; and second, a moderate variation in SO_3 content may occur without causing any appreciable variation in the time of set of the cement.

Thus the conclusion is reached that plaster of Paris is the form of calcium sulphate which is the most active in its effect upon the time of set of Portland cement clinker. Gypsum is less efficient and anhydrite has practically no effect on time of set. The fact that it is necessary to control the SO_3 content so closely when plaster alone is used is a disadvantage, especially since the maximum SO_3 which can be used as plaster may still be below the maximum SO_3 content of 2 per cent and often below the percentage required for the highest strength of the cement. Mixtures, therefore, seem to be more desirable than any of the forms alone, and all the available information points to the conclusion that mixtures are actually being obtained in present mill practice. Some important points in choosing the most desirable type of mixture are discussed in connection with the effects on strength of clinker.

An Economical Change

Savings of ten cents a yard together with a 100 per cent increase in capacity resulted from a change-over by the Vincennes Sand and Gravel Company from steam to electric drive in pumping gravel. This company was operating a steam-driven pump on a gravel pump boat at Vincennes, Indiana, and the Indiana Power Company recently installed a General Electric, 60-horsepower, slip ring motor and control to supersede the steam drive.

The new electric equipment now pumps 227 yards of gravel in ten hours as compared with 115 yards in the same time by the old steam method. The pump is keeping 21 Ford trucks and two larger trucks busy in hauling away the gravel.

When operating with the steam engine, the gravel company paid 90 cents an hour for an engineer and $7.50 for the coal consumed in a ten-hour day. On this basis, 2,990 yards of gravel were produced in a 26-day month at a total cost of $429, making the production cost of a yard of gravel approximately 14⅔ cents. With the motor, however, 5,902 yards of gravel are now produced per 26-day month, and a typical power bill was $149.24 or $5.74 a day which, with an operator at $4 a day, cut the cost of operation down to 4⅓ cents a yard.

The Pennsylvania Pump and Compressor Company now have ready for distribution their new General Products Catalog Number 125. This catalog presents in a clear cut and concise form a comprehensive view of the complete line of this company's product.

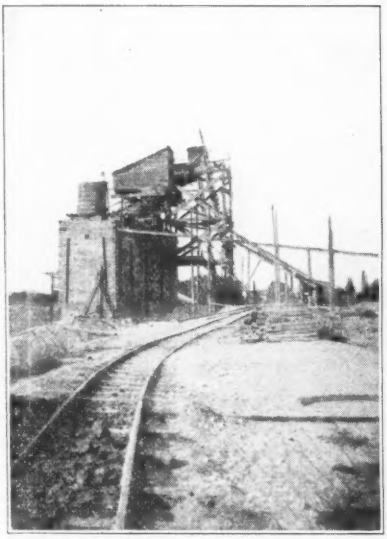
A Canadian Sand and Gravel Operation Produces 1000 Tons Per Day Efficiently

By H. W. Munday

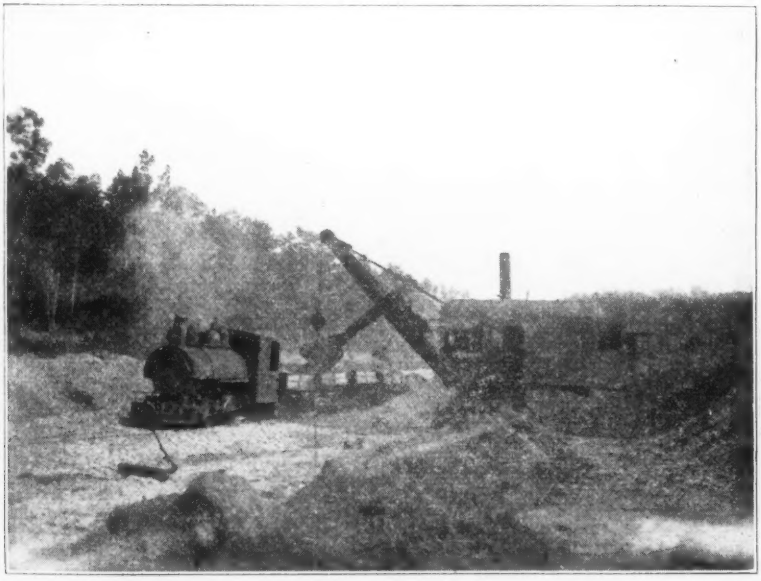
CONCRETE has assumed an importance in the structural field in Canada that compares favorably with its position in the United States. Concrete aggregates are at last receiving the attention that they merit in Canada. Modern plants with efficient water-washing, crushing and screening equipment are turning out a standard product and the slip shod methods of former days are disappearing.

One of the most efficient sand and gravel operations in Canada is that of Messrs. Conlin and Johnson. It is admirably situated on the Canadian Pacific Railway, only twelve miles out of the City of Toronto, which with its suburbs form the chief market for its products. The property, located on the bed of the old Lake Iroquois, comprises some one hundred acres which have been thoroughly test-holed and found to run approximately fifty per cent gravel.

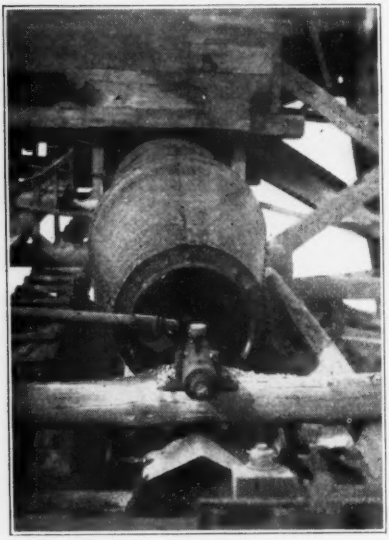
A new working face was opened a short time ago, being some four hun-



The Screening and Washing Plant.



View in Deposit of Conlin and Johnson.



One of the Conical Screens.

dred yards from the washing plant. The overburden which is very light, rarely if ever exceeding eighteen inches in depth, is stripped by a Marion steam shovel. Owing to the freshness of the face, a working depth of only fifteen to eighteen feet is being used at the present time, but every condition indicates that excellent gravel will be found at much greater depth. The bank material is loaded into a train of four yard side dump cars by a Model 35, full revolving Marion steam shovel, using a yard and a half dipper. The train is then pulled over a 36 inch narrow gauge track to the screening plant by a twenty ton Porter steam locomotive.

The side dump cars deliver the bank material through a three inch horizontal grizzly into a concrete hopper, large enough to accommodate a whole trainload. Any large oversize is caught on the grizzly and is delivered into the crusher. The material under three inches in size is fed by five undercut gates through the bottom of the hopper to a twenty-four inch belt conveyor, which in turn feeds a 24 inch bucket conveyor 62 feet centers. The buckets spill the material over into a scalping screen. This screen has 2⅜ inch round perforations, which separate the bank run into oversize and undersize. The undersize proceeds through the washing and screening plant, the oversize is delivered by gravity to a Champion jaw crusher, which after crushing returns it to the plant hopper, thence through the same procedure.

The washing and screening operation is of the utmost importance. The angle of the bank of screens and the flow of water must be exactly suited

Locomotive Crane Used for Switching and Loading from Stock Pile.

to requirements to insure materials running through the screens at the proper speed to give aggregates properly sized and thoroughly cleansed. In this plant a natural water supply is found in a river running 100 yards north of the washing plant. This is dammed up in the spring, insuring an adequate supply for the running season. The water is led to the plant by a flume and pumped to the screens by a Gould centrifugal pump, giving 700 gallons per minute.

A bank of Link Belt conical screens on a slope of 3 inches to the foot, varying in size from ¼ inch to 2 inches is used. Each screen has a battery of jets pouring water under pressure into the running material. The sand, silt and water emerging from the last screen are led by a water pan to two Link Belt automatic sand separators, which separate the coarse and fine sand. The silt and water flow over into a spillway which removes them to a considerable distance east of the plant. The prepared materials drop in each case to their own particular bunker under their screen or separator as the case may be. The prepared materials are being constantly tested for size, abrasion, and organic content, to insure the output only of standard materials suitable for the highest grades of work.

The Railroad Company pulls the loaded train out each night, returning with a train of empties which are blocked just north of the screening plant. The empties may be loaded directly from the bunkers in the screening plant or from the extensive stock piles. In loading from the bunkers, the empties are dropped down by gravity and loaded by side loading chutes. If the cars are to be loaded from stock piles, they are moved by the Company's crane to their respective position.

The plant is substantially built of heavy timber construction, bolted joints, on a mass concrete foundation. It is designed to allow doubling up on screens and washing equipment, as well as another loading track, thus to double the total output. The present output is 1,000 tons per eight hour day.

The management of the plant is under the able supervision of Mr. T. R. Johnson; the office and sales are under the management of Mr. H. L. Conlin at Toronto. Mr. Bruce Matson is retained as Consulting Engineer.

Concrete Products Convention

The annual national convention of the Concrete Products Association will be held in the Hotel Cleveland, Cleveland, Ohio, January 27, 28, 29, 1926. The special feature of this year's convention will be the discussion of sales promotion. Most of the papers to be read will deal with various phases of advertising and selling.

A tentative program has already been prepared with papers on "Personal Salesmanship," "The Plant as an Advertising Asset," "Circular Letter Advertising," "What to Do and What Not to Do in Newspaper Advertising," "Boosting Stucco to Help Block Sales," and "Fire Insurance Rates and Their Effect on Sales," to be among the discussions deemed suitable to this year's business.

Cleveland was chosen as the 1926 meeting place as a result of a special delegation's efforts in the Milwaukee meeting in 1925. Inasmuch as Ohio is one of the foremost producers of concrete block and other concrete products, the meeting place this year was well chosen.

The latest statistics available indicate that there are now some 10,000 manufacturers of concrete products in this country and Ohio alone has more than 800 manufacturing plants. This year's meeting is open to all manufacturers whether they are members of the Association or not. It is expected that the central location of Cleveland will assure a large attendance with delegates coming from every state in the Union.

New officers for 1926 will be chosen at the meeting to succeed W. H. Carey, Wisconsin Rapids, President; S. I. Crew, Norwood, Ohio and C. E. Lindsley, Irvington, N. J., Vice Presidents; Bert Carey, Chicago, Secretary; and Jacob Bosch, Treasurer. These men were the officers for 1925. New directors of the association will also be chosen.

Another Consolidation

The Racine Crushed Stone Company, the Milwaukee Crushed Stone Company and the Liberty Lake Gravel Company have consolidated under the name North Shore Material Company. The management will remain the same. The general offices of the company are at 133 West Washington Street, Chicago, while the Milwaukee office is Room 402 Wisconsin Theatre Building.

SALUDA CRUSHED STONE CO
Greenville, S. C.

Sept. 24, 1924.

The Fate-Root-Heath Co.,
Plymouth, Ohio.

Gentlemen:

With the Plymouth 7-ton Gasoline Locomotive which we installed about a year ago we are hauling 1,000 tons, 800 feet per day on less than ten gallons of gas. This tonnage would have been impossible with mules.

The Plymouth has certainly proven a money-maker; it is always ready to go, and the upkeep has been practically nothing.

Very truly yours,
SALUDA CRUSHED SONE CO.
(Signed) By W. H. Cook,
President.

Hauling 10 To

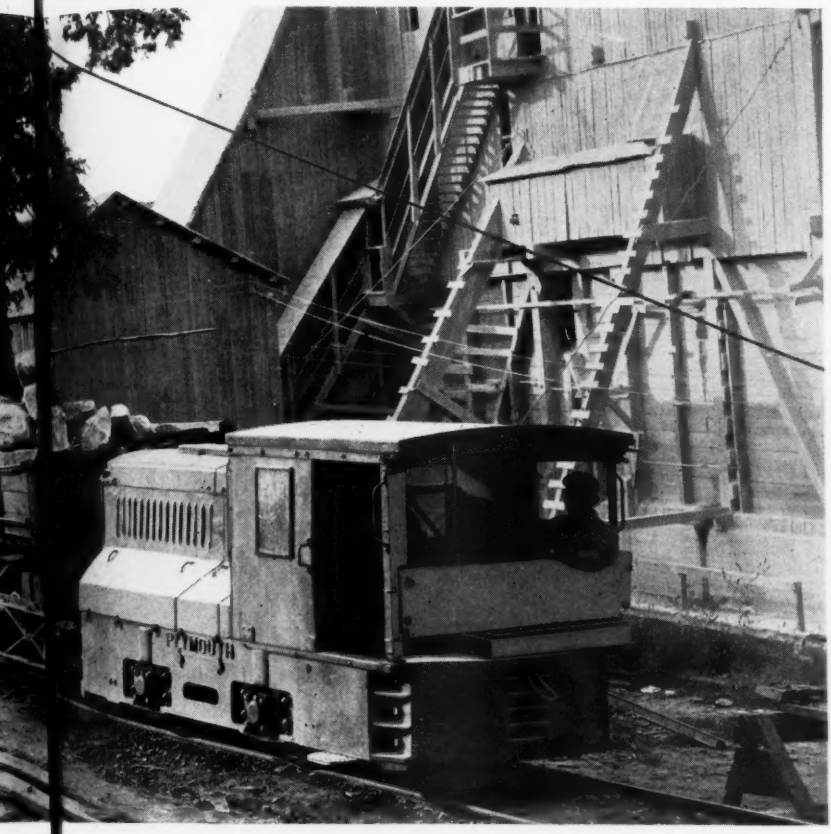
The Saluda Crus one C
quarry, but their ha was
imperative.

Then they instal Plymo
in the adjoining lette ld be
haulage.

ur Pe

THE FATE-ROOT H CO

Gasoline PLYM



g 10 Tons on 10 Gallons of Gas

la Crus one Co. of Greenville, S. C., were using mules in their
heir ha was slow and expensive. Increased production was

y instal Plymouth 7-ton Gasoline Locomotive. What they say
ng lette ld be convincing proof of the advantage of Plymouth

r Performance Bulletins "C" and "F"

ROOT H CO. (Plymouth Locomotive Works), Plymouth, O.

NOUTH Locomotives

Prime Movers in Stone Quarries And Sand and Gravel Pits

By C. H. Sonntag

Part II

The first part of this article appeared in the November 1st number of PIT AND QUARRY. The author in part one discussed the conditions under which a plant should generate its own power, the slide valve steam engine and the automatic steam engine. The uniflow engine, the steam turbine and steam power in general are discussed in this part.—Editor.

The Uniflow Engine

In the conventional form of steam engine cylinder the steam on admission follows the piston to the end of its stroke, filling the entire cylinder volume and remaining there until pushed out through the exhaust port by the piston on its return stroke. When the steam is admitted, it is at high pressure and consequently at high temperature. As it expands its temperature lowers, and, being in contact with the cylinder walls, the latter cool down also. Then when on the next stroke fresh hot steam is admitted, some of it condenses at once on the cool cylinder walls, resulting in a serious loss of efficiency, as this condensed steam has done no work. An important part of the steam used in the engines most of us are acquainted with is wasted in this way.

The idea seems to have originated in Germany that if the steam could be gotten out of the cylinder immediately on the completion of its expansion, and without waiting for the return stroke of the piston, its time of contact with the cylinder walls would be shortened and its cooling effect on them minimized. The mechanical construction developed to carry out this idea consists basically of a piston nearly as long as its own stroke, a cylinder slightly more than twice as long as the stroke, and the provision of a ring of exhaust openings around the middle of the cylinder which are uncovered by the piston at the end of each stroke. Some accessory parts are necessary, but these three items are the essence of the invention.

It will be seen that most of the steam that has just done its work can leave the cylinder at once by these central ports. That remaining in the cylinder is compressed in the clearance space on the return stroke, raising the temperature of the walls of that space practically to that of the incoming steam, and hence largely doing away with cylinder condensation. The "uniflow" engine, whose name means that the steam moves in one direction only, is in consequence as economical in steam as the conventional compound units.

There is no vital reason why a steam cylinder exhausting in this way can not be built with any of the types of admission valves and governors in common use on other engines. However, as actually constructed they usually, though not always, embody some of the features of large gas engines. The valves and governor are driven by a "lay-shaft" parallel with the cylinder and driven by bevel gears from the crank shaft. These gears in the steam engine are miters with a 1:1 ratio, while in gas engines they usually have a ratio of 1:2. The governor is of the horizontal centrifugal type, mounted directly on the lay-shaft, and controlling the engine by varying the point of cutoff. The valves are of the direct lift, or poppet class, actuated by eccentrics on the lay-shaft. These valves require no lubrication on their seats, and so permit the use of superheated steam,—a thing that has not always met with entire success in engines whose valves have rubbing surfaces.

While the basic idea of the uniflow cylinder does not involve the use of mechanically actuated exhaust valves, most builders provide them in order that the engine's compression pressure may be adjusted. Only a minor portion of the steam passes through them, most of it going through the parts uncovered by the piston. These exhaust valves are poppets, very similar to the admission valves, and actuated in the same way.

The uniflow engine will appeal to the man who is interested in fuel economy in his power plant. One maker claims his engine will run with 30 per cent less steam than any single cylinder machine of the same size

of the older types. This same statement may be made in another way by saying that a single cylinder uniflow will have the same steam rate as an ordinary compound of the same horsepower, and this will apply whether the two engines to be compared are both running non-condensing or both condensing.

The uniflow engine is not made in very small sizes, but may be had as large as is apt to be desired by the crusher or gravel operator.

The Corliss Engine

Until the advent of the steam turbine this was the standard heavy duty engine of America, and it is still giving faithful service in many places. Where heavy line-shafts must be driven, it and the uniflow are about the only available machines in large sizes, and the principal limitation to its use has come about through the purchase of electric energy and the subdivision of power transmission by the installation of electric motors.

The distinctive parts of the Corliss engine are its cylinder and valve gear. A complete description would be rather involved and out of place here, and it will suffice to say that steam distribution is by means of four independent valves, oscillating through part of a revolution in seats bored transversely to the cylinder at its corners. The valves are actuated by an eccentric on the main shaft, and in the better engines intended for heavy duty and occasional overloads the steam and exhaust valves receive their motion from separate eccentrics, as better steam distribution can be had in this way. The link-work operating the valves is so designed that rapid motion at the moments of opening and closing is obtained, and speed control is by varying the point of cut-off under the action of the governor. This is done by releasing the steam valves after part of the stroke is completed, the valves being quickly closed by the pull of dash-pots which also cushion their final closing. The details of the mechanism for accomplishing this differ among the various builders, but the final result is the same.

The Corliss engine is hardly desirable in sizes below 100 h.p., but may be had as large as any stone crusher will wish. It is essentially a slow-speed machine, 125 r.p.m. being about the upper limit of its speed, beyond which the steam valve release becomes unreliable. It may be had as a single cylinder machine, as a tandem compound, that is, with the cylinders in line with each other and using a common piston rod, and as a cross-compound, which is practically two separate engines side by side, using a common crankshaft, and with the steam passing successively through the smaller and larger cylinder. Compounding is used to save steam by lessening cylinder condensation, which was discussed in an earlier part of this article. The tandem compound is cheaper per horsepower than the cross-compound as some duplication of parts is avoided, but it is not as accessible for repairs to the cylinder next to the shaft.

In order to get more power from a given weight of metal through the use of higher speed, a type of engine known as the non-releasing Corliss has come into use. The principal difference from the standard Corliss is that the steam valves are never released from their links, and so there are no dash-pots. The design of the operating mechanism is such that the motion of the valves is very rapid at the points of opening and closing, even without dash-pots. Speed control is by means of a shaft governor regulating the motion of the steam valves. As neither dash-pots nor gravity is depended upon in the operation of these engines, speeds up to 200 r.p.m. are practical.

Small steam engines, in the neighborhood of five to ten horse power, are frequently wasteful of steam, as it is not easy to keep down valve and piston leakage. In such cases they may use 65 or 75 pounds of steam per horse power hour. Larger sizes are more apt to be kept in good condition, and they are inherently somewhat more economical.

Table 1 gives an idea of the steam rates of engines of various types and under different conditions, and is based on the indicated horse power hour. The brake horse power hour, available for useful work is about 90 per cent of the indicated power in small engines and 95 per cent in large ones.

Table I.

Type of engine			
Simple non-condensing	33	29	26
Simple condensing	27	22	22
Compound condensing	20	15	15

The Steam Turbine

There was a time when the turbine was looked upon by the small plant operator as a rather delicate piece of

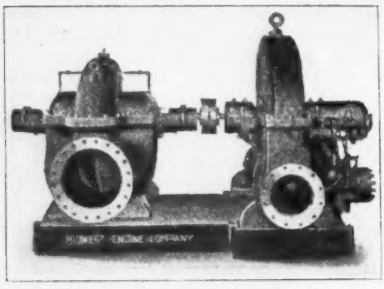


Figure 3—A Pumping Unit.

apparatus, easy to get out of order and hard to repair. If that was ever a fact, it has long since ceased to be so, and these machines will give wonderfully reliable and continuous service. They contain no pistons, and the steam does not do its work by direct pressure, but by the force of one or more jets at high velocity striking the concave surface of crescent-shaped blades mounted on the edge of a disc or the surface of a drum. The nozzles through which the steam emerges are specially shaped to give the highest velocity to the jet by allowing the steam to expand under carefully controlled conditions. In some types the blades may also act as expansion nozzles.

Turbines have never had much application where belt drive from the prime mover is imperative. One reason is that they do not have the high starting power from standstill that is possessed by reciprocating steam engines. This is because the jet of steam is very inefficient when striking a stationary blade, while full boiler pressure can be exerted on the entire area of a piston. Another reason for the inadvisability of belt transmission from turbines is that they are inherently high speed machines, which would make their pulleys impractically small in diameter, on which belts would not work well. It is true that some turbine builders are prepared to equip their machines with high grade reduction gears so that the second shaft may run at a reasonable speed, but the fact remains that the very great majority of turbines are direct-connected either to centrifugal pumps or electric generators. Either of these may be designed to work efficiently at the high speed of the turbine.

A pumping unit so arranged is a compact and reliable machine. Such a combination may be seen in Figure 3. The pump shown in this has a single stage, and is suitable for large volumes and moderate head. If higher pressure is to be worked against, the pump may have more than one stage.

The smallest and the largest prime movers in commercial use are steam turbines. In the smaller sizes, from ½ kilowatt up, they make compact, fool-proof sources of current for isolated lighting systems. A little farther up in the scale of capacity they may be used for supplying current to motors as well.

A good idea of the appearance of a turbo-generator set of moderate size may be had by studying Figure 4. This particular machine is an alter-

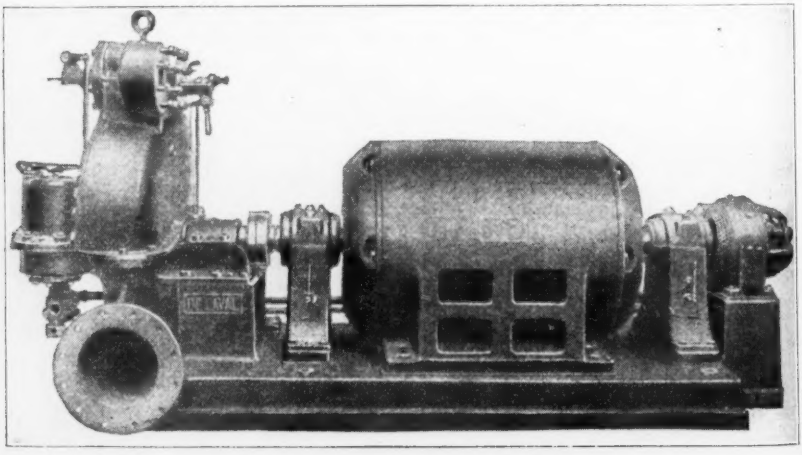


Figure 4—A Turbine Generator.

nating current set of 200 kilowatts capacity, and it will be noted that the turbine, generator and exciter are all coupled together and mounted on a single bed-plate. It would be difficult to imagine a more compact design. This turbine is more economical in the use of steam than the single stage machine because there are several rows of blades on which the steam strikes successively on its way to the exhaust.

If a still larger power source is needed, a selection of such a turbo-generator as is seen in Figure 5 will be made. These may be had in capacities ranging from about 300 kilowatts up into the sizes that no one but a public utility will need. They are strictly high grade machines, and in them every element that can reasonably contribute to steam economy and reliability of operation is included. Automatic circulation, cooling and filtration of the oil goes on as long as the turbine is running. Operation is practically always condensing, and the steam expands to many times its original volume in passing from the throttle to the exhaust. Details of the various designs will not be gone into here, as not many crushing plants will need to purchase such a machine, and if it is done, the engineering should be in the hands of a man familiar with current power plant practice.

At the other end of the scale in size from the generator just mentioned is the little headlight set. It consists of a small turbine coupled to an equally small generator, always direct current, the whole being designed so as to be absolutely weather proof. They range in capacity from ½ to 3 kilowatts. They may be seen mounted on the boiler of almost any steam locomotive in the country, and Figure 6 is an illustration of one of them. These little machines are mentioned here because they are wonderfully handy units for mounting on steam shovels and locomotive cranes for night work. They may be had wound for either 32 or 110 volts, and the smallest is large enough for the average shovel or crane. If wound for 32 volts, they will operate standard locomotive headlight projector lamps with concentrated filaments, while if wound for 110 volts they can be used in the plant if only a few lights are needed during the night or when the larger machines are shut down.

The steam consumption of turbines

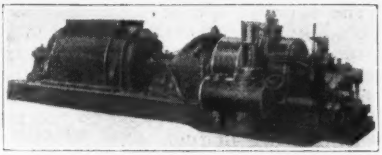


Figure 5—A Turbo Generator.

will vary somewhat with the type and with other conditions, but table II will give a fair idea of what may be expected.

Table II.

Type of turbine

Single wheel, about 15 kilowatts, 75 lbs. per kilowatt hour, non-condensing.

Multi-velocity stage, 100 kilowatts, 45 lbs. per kilowatt hour, non-condensing; 24, condensing.

Reaction or impulse, 1000 kilowatts, 33 lbs. per kilowatt hour, non-condensing; 17, condensing.

From this it may be seen that the smaller sizes of turbines are no more economical in steam than good reciprocating engines, but they have the advantage of compactness and light weight. In making this comparison it should be borne in mind that the turbines are rated on the kilowatt hour basis while the consumption of piston engines is stated per horse power hour, and a kilowatt is about 1⅓ horse power.

A study of turbines I and II will show that the steam used by medium and large sized engines and turbines is much less when they are operated condensing. This amounts to reducing the pressure against which the exhaust must leave the machine, and so allowing work equivalent to that pressure to be done in the machine. To get the best results from the use of a condenser, the engine, and particularly the turbine, should be bought with the understanding that it will be so operated, for the exhaust piping of both kinds of units should be larger to handle steam under vacuum, since its volume is greatly increased. The design

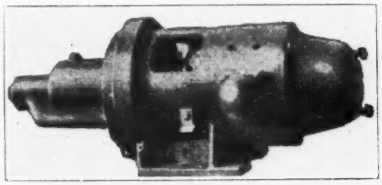


Figure 6—Small Turbine Coupled with Small Generator.

of the exhaust end of a turbine, both in blading and steam passage, is much more liberal than for non-condensing use, which makes the machine more expensive, but under conditions the difference in cost is repaid in the end by the saving in fuel.

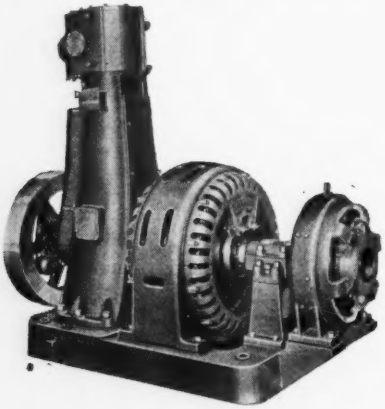


Figure 2—Alternating Current Generating Set.

This matter of condensing is mentioned here so that anyone contemplating the installation of a power plant in which it might be warranted may bear it in mind; but as the choice and operation of condensers is a broad subject in itself, a further discussion will not be attempted at this time.

Steam Power in General

In closing the subject of steam engines and turbines a brief summary of their proper applications may be made.

The smallest unit, the little headlight set, is, as its name implies, best suited to supply a few lights for night operation in steam shovels, drag-line excavators and locomotive cranes. In the larger sizes, it would probably be able to light up a slack cable gravel digging and screening plant. It is a completely self-contained outfit requiring no switchboard and only infrequent attention.

Where a larger plant is to be lighted a turbine like that shown in Figure 3 may be coupled to a direct current generator, or a vertical direct-connected engine set like Figure 2 may be selected, using direct current instead of alternating, or an engine of this type may be belted to a high speed generator. Such an outfit will, of course, operate small motors within its capacity, as for instance to drive a pump some distance from the power house. The larger engine generator sets will preferably be of the horizontal automatic type.

For lineshaft drive up to about 150 horse power horizontal engines, either throttling or automatic, may be used, with the preference for the latter if much running at partial loads is to be done.

For still larger plants needing over 150 horse power, and where the drive is to be by belt to a line-shaft, the Corliss engine will fit in very nicely. It will handle the heavy starting load easily, and if given reasonable care will give steady service for many years. Single cylinder engines may be run condensing, but to get the most value from this the engine should be a compound. In fact, compound condensing is really the best field for the Corliss engine. It may of course, be belted or direct connected to either an alternating or direct current generator, and many excellent units of this sort may be had in the used machinery market. The large Corliss engine was doing practically all the work in the central stations of the country until the advent of the steam turbine.

Practically everything that has been said of the Corliss engine will apply to the uniflow machine, except that a simple non-condensing uniflow will use about the same amount of steam as other non-condensing compounds, or about 30 per cent less than other non-condensing simple engines. A condenser may also be used with the uniflow with a considerable saving in steam.

If a plant is to be motor equipped, either as individual or group drives, and can not or does not wish to buy power from a central station, the steam turbo-generator set should be given serious consideration where good boiler water and cheap coal may be had. They give as reliable service as an engine, but to get the greatest benefit from them the larger ones should always be run condensing where, as in the case of crusher plants, there is no use for the exhaust steam.

Appointment of Mr. Jesse C. Bader as western sales manager of the Ohio Locomotive Crane Company is announced. Mr. Bader's office is in the Railway Exchange Building, Chicago.

Recovering Gold Increases Profits For Sand and Gravel Plant

By E. D. Roberts

MANY producers working sand and gravel deposits, especially on the Pacific Coast, have wondered whether or not it would pay to recover the gold contained in their deposits. The Service Rock Company is recovering gold as a by-product and finds it profitable. This operation was discussed in the September 15, 1925, number of PIT AND QUARRY. The Atlas Rock Company, whose operations are discussed elsewhere in this number also find that they can recover gold at a profit. As further evidence of the profitable recovery of gold we offer this article on the Grant Rock and Gravel Company's operations at Friant, California. A plant capable of producing a by-product should consider seriously the advantages of such production. If gold is present, a study should be made to determine the practicability of recovery and its effect in increasing profits.

The Grant Rock and Gravel Company is producing 2,000 tons of crushed rock, sand and gravel daily. By recovering the free gold in their deposit they have realized on an average five cents in gold for every ton of material produced. This sum of $100 per day has offset some handicaps such as a high freight rate to Fresno, the main market and the surplus of sand which is produced. It is a protection during periods of keen competition when the market is not especially good.

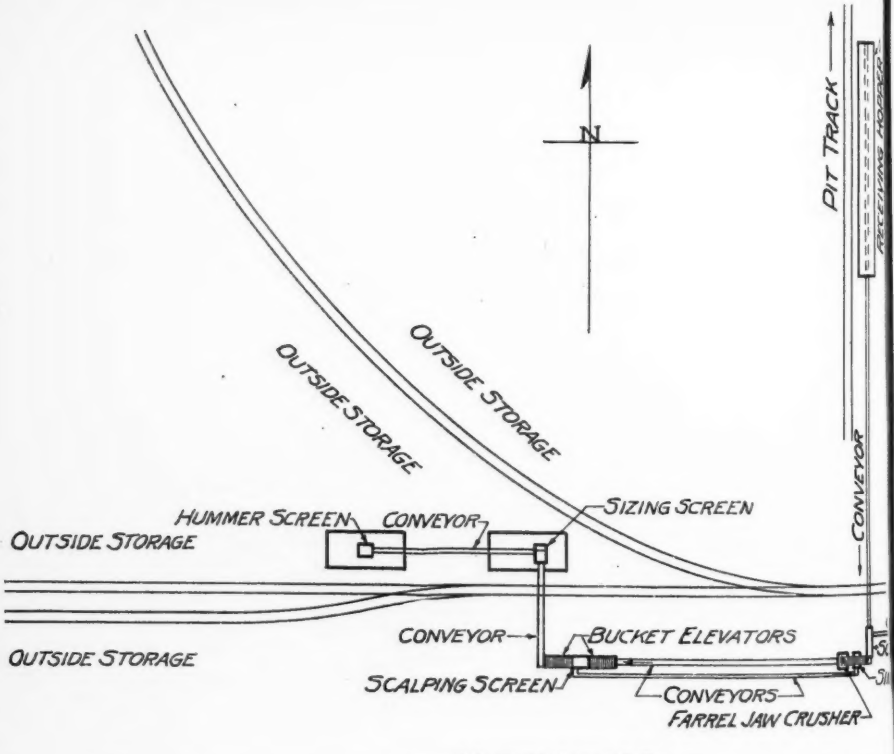
The plant operated by the Grant Rock and Gravel Company is located near Friant on a branch of the Southern Pacific Railroad about 20 miles from Fresno. The material handling features of the plant are particularly efficient. That the plant is well designed is attested by the fact that very seldom is any part of the plant idle.

The gravel deposit is a high bar left by the San Joaquin River sometime in the distant past, with gravel and sand carrying gold over bedrock to a depth of 15 to 25 feet overtopped by from 3 to 6 feet of silt. At ordinary stages the water level of the river is below the bedrock underlying the gravel deposit.

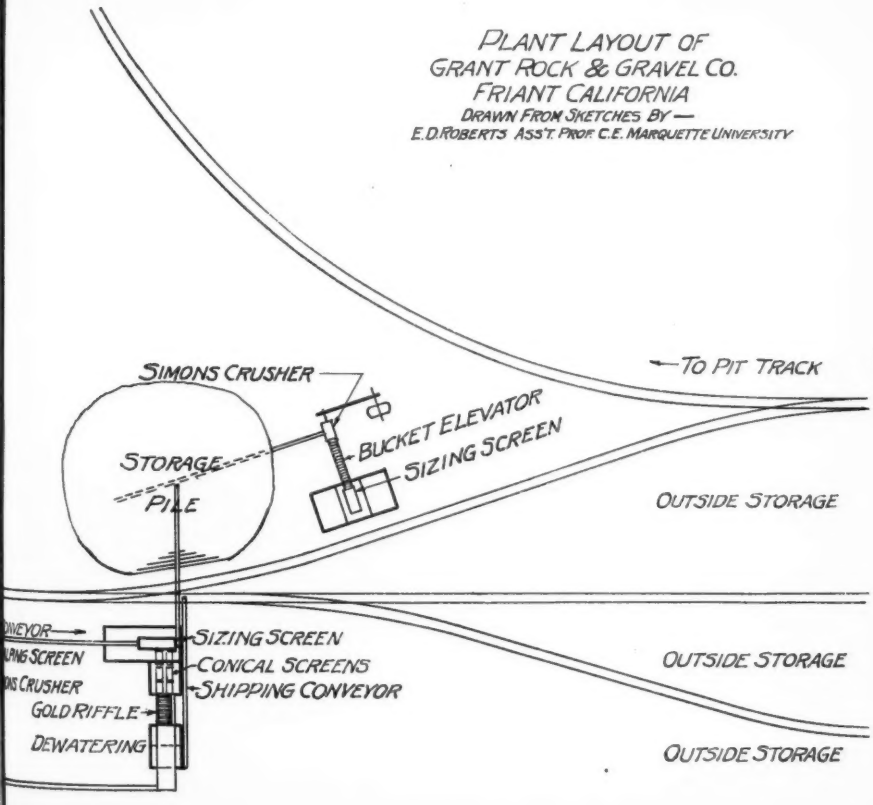
A 90 ton Atlantic oil burning steam shovel excavates the sand, gravel and silt cleaning the bedrock with one cut and loading the material into side dump 20 and 40 yard Western dump cars. An American steam locomotive handles three of these cars at a time hauling them over a standard gauge track to the plant receiving hopper, about half a mile from the present shovel setting.

View in Pit of Grant Rock and Gravel Company.

View Showing Distribution of Plant Units



...nt Units Which Eliminates Congestion.



Waste Area for Sand and Water Disposal.

The receiving hopper is constructed of reinforced concrete and is long enough so that three cars may be dumped at one spot of the locomotive. Railroad rails placed over this hopper form a grizzly to retain any stones over 8 inches in size. These boulders are raked off to one side to be broken at odd times. Very little trouble is experienced with them, however. Three plate feeders located under the hopper control the flow of material to a 36 inch belt conveyor operating in a tunnel underneath the hopper. Any one, two, or all of the feeders may be operated at a time depending upon the requirements of the plant and the material received.

After emerging from the tunnel under the receiving hopper, the belt conveyor carries the material up an incline and over a yard track to discharge into a scalping screen which passes material under 2½ inch in size and rejects the larger sizes. The processing divides here, and we will follow the small sizes through and return to take up the oversize material later.

Discharged from the scalping screen the sand and gravel is carried up an inclined 30 inch belt conveyor to the sizing screen at the washing plant. Here a large revolving Stevens Adamson combination scrubber and screen, into which a large stream of clean water is placed for washing, thoroughly scrubs the material and separates all the material over 2 inch in size from the sand and gravel below that size. That under 2 inch is discharged into a pair of conical Gilbert screens for further classification while the oversize is discharged into a shipping bin under the screen or if the bin is full, it is chuted onto a belt conveyor which carries this large size over the yard tracks and discharges onto an outside storage pile.

A hopper has been constructed under this outside storage pile with feeders to an 18 inch conveyor belt operating in a tunnel under the pile for reclaiming the material for further reduction. This conveyor belt discharges into a Symons crusher which reduces the material to a 1½ inch maximum and discharges it into a bucket elevator which elevates it to the top of the shipping bin where it is discharged into a sizing screen which gives three sizes of crushed rock and dust. A 75 h.p. Westinghouse motor furnishes the power for operating this part of the plant.

The sand and gravel below 2 inch in

Flume for Carrying Sand and Water To Waste Area Shown in Illustration Above.

size and carrying the wash water is divided before entering the Gilbert screen so that half of the stream goes to each set which classifies the material into the desired sizes. The first screen takes out the 1¼ to 2 inch; the next sorts out the ½ to 1¼ inch and the last separates the ¼ to ½ inch pea gravel from the sand. Each size falls directly into the shipping bin for that sized material located underneath the screen.

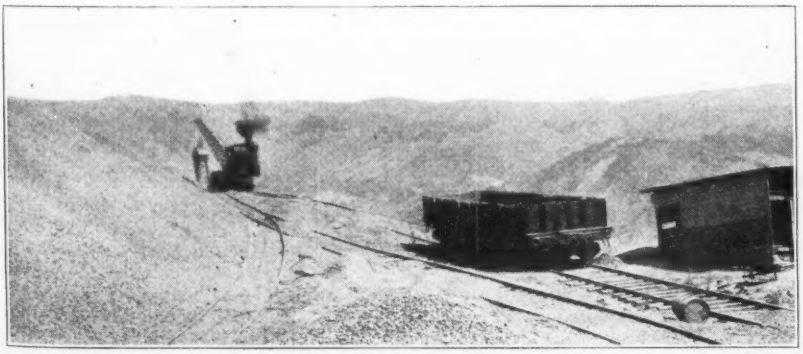
The sand and water then passes over the gold recovery tables. These tables are a series of riffles set at the proper slope to allow the heavier materials to settle into the pockets formed by the cross bars. An old Alaskan placer miner diverts the stream from the riffles at intervals while he scoops up the gold and black sand which accompanies it. When cleaned the riffles again receive the stream of sand and water as before. The black sand and gold is treated with quicksilver of mercury forming an amalgam with the gold. This amalgam is sent to a smelter for distillation of the mercury from the gold. The mercury is again used for recovering more gold from black sand as before. After passing the gold recovery tables, the sand is settled off in automatic settling tanks and the muddy water flumed to low land below the plant where it is wasted out of the way of everything.

A 28 inch conveyor belt operating along the face of the bins carries the different sizes, which have been drawn from the bin, and discharges onto it out over the tracks and discharges into the railroad cars for shipment or to be placed in outside storage.

The oversize material from the first scalping screen goes to the dry crushing plant and passes over a grizzly which allows the smaller gravel to fall into Symons disc crusher and chutes the larger gravel into a Farrel jaw crusher, both crushers discharging onto a belt conveyor which discharges into a bucket elevator. This bucket elevator discharges the crushed material into a scalping screen which rejects the material over two inch in size. The oversize material is discharged onto an inclined belt conveyor which carries it back to the Symons disc crusher and discharges it for final reduction.

The material passing the scalping screen is carried up another bucket elevator and discharged onto a belt conveyor which transports the crushed rock to the sizing screen over a shipping bunker. The screen passes the material under 1¼ inch to a conveyor belt while the 1¼ to 2 inch falls directly into the shipping bin below. The smaller material is conveyed to another bin alongside the first bin where a Hummer screen eliminates the material below ¼ inch from the rest. Both sizes fall into bins below the screen. A dust collecting system with openings at the crushers and both sizing screens sucks out the dust and discharges it into the atmosphere.

All of the shipping bins are arranged to handle the crushed rock, gravel, or sand directly into the cars for shipment by spouts and gravity discharge. In case the material is not moving out to market as fast as the plant produces it, it is drawn off onto side board flat cars, borrowed from the Railroad Company for this purpose, and piled on yard storage piles along the tracks. These flat cars are handled and unloaded by two Brownhoist locomotive cranes using



Outside Storage System.

clamshell buckets. One locomotive crane is a 15 ton and the other a 30 ton crane. These locomotive cranes also reclaim the material from the storage piles for shipment when the plant output cannot supply the demands of the market.

The plant output is 40 cars of sand, gravel and crushed rock daily, most of which is hauled over the Southern Pacific Railroad to Fresno for distribution.

Some will wonder at the different shipping bins so widely scattered. The number is the result of plant growth, and their location is the result of a desire to relieve congestion at the bins, allowing the use of two locomotive cranes and switching locomotives with a minimum of tie-ups.

A 10-inch De Laval centrifugal pump located at the river furnishes the plant water and the water for washing the sand and gravel. This pump not only washes the material, but by doing so it eliminates the removal of a large overburden of silty material with its resulting cost and delays. Electric power is received from the San Joaquin Light and Power Company at 11,000 volts pressure and is stepped down at the plant to 440 volts.

The company furnishes the men with housing and maintains a store to supply them with their necessities. The main offices of the company are maintained in the Cory Building in Fresno where Mr. H. E. Estes, President of the company, has his headquarters. Mr. Frank B. Peterson is Vice President; Edward Schles, Secretary; and J. D. Hill, Sales Manager. Mr. Harry Frost is plant superintendent with headquarters at Friant.

The opening of new offices in Portland, Oregon, by the Marion Steam Shovel Company is announced. Mr. Z. A. Toye of the H. J. Armstrong Company, Seattle, is in charge.

Research Council Changes

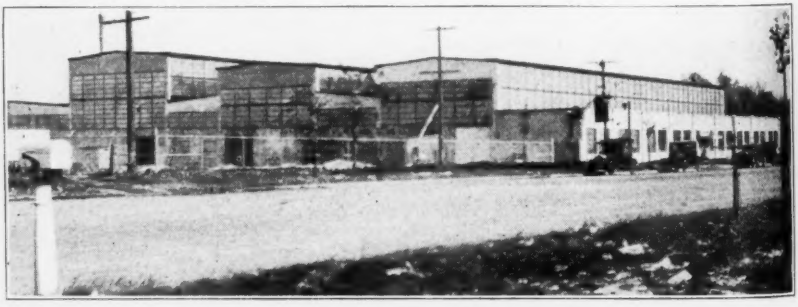
Announcement is made by Director Charles M. Upham, Highway Research Board of the National Research Council, that Professor S. S. Steinberg of the University of Maryland has been appointed Assistant Director of the Board. He will also for the present continue to serve as Acting Secretary of the Investigation on the Development of Earth Roads now being conducted under the auspices of the Highway Research Board. Professor Steinberg served as Assistant Director during the summer of 1924.

H. F. Janda, former Assistant Director, has been designated Secretary to Research Committees in accordance with the new policy of the Board to employ technical assistants who shall devote full time to research committee work. Professor Janda will return to his duties at the University of North Carolina on January 1, 1926 at the expiration of his leave of absence.

New Telsmith Plant

When this number of PIT AND QUARRY comes from the press the Smith Engineering Works will probably be occupying their new plant in Milwaukee at 78 Lake Boulevard.

In the new plant all the manufacturing operations will be conducted under one roof. The building is 244 feet 8 inches by 195 feet and is of fireproof construction with a steel super structure, concrete floors, brick walls and clay tile roof. The plant is equipped with five P. and H. Cranes, built by the Harnischfeger Corporation. Six acres of ground have been purchased which will permit of further expansion if needed. Track connections are in which connect with both the Chicago Northwestern Railroad and the Chicago Milwaukee and St. Paul Railroad.



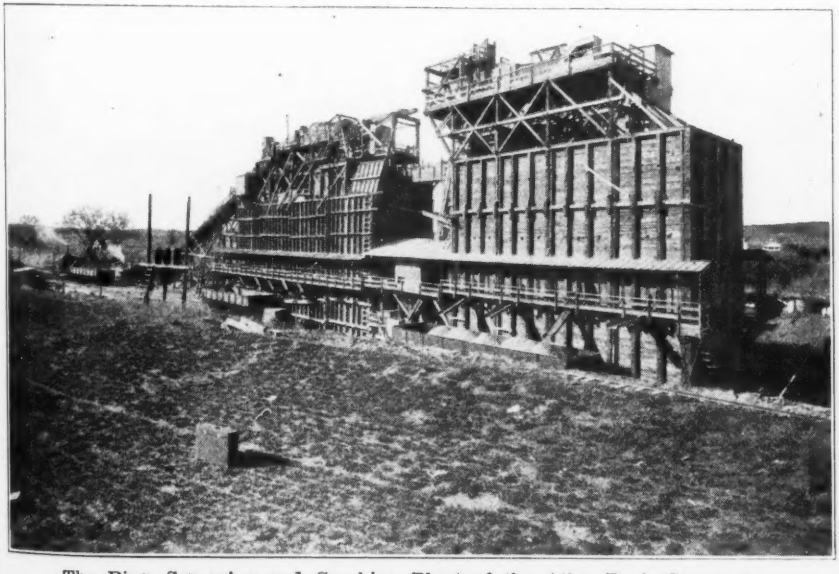
The New Plant of Smith Engineering Works.

A Single Contract Doubles Capacity In This California Plant

By H. W. Munday

SINGLE contracts that would necessitate doubling the capacity of the plant are not generally sought after in either the crushed stone or sand and gravel industry. However, the Atlas Rock Company of Stockton, California, went after and secured a contract to supply the concrete aggregate for the Melones Dam. This is one of the many irrigation and power projects now under construction in California. The contract calls for approximately 200,000 tons of material to be delivered at the rate of 2,000 tons per day. At the time the contract was secured the plant capacity was only 1,000 tons per day. Deliveries were to start the first of November this year. The Atlas Rock Company had anticipated their success in securing this contract and had determined what changes and additions would be necessary to produce the material. The original plant had been built with allowances in many instances for such a needed increase in production. Engineers in their designs of the original plant recommended that ample provisions be made for a possible increase in production. Fortunately the Atlas Rock Company was prepared. How many plants in the original construction make all such allowances? These remarks apply to the mill plan of the Atlas Rock Company's plant. Changes, of course, were necessary, but they had to do with the pit, the deposit and the haulage of the material to the washing and screening plant.

An 18 ton Plymouth locomotive equipped with a six cylinder 6x7 Climax motor was purchased. Six 12 yard Western automatic dump cars and ties and rail enough to build about 1½ miles of railroad were purchased. This railroad equipment was used to build a tail track large enough to accommodate about eighty cars and to work a new deposit which was uncovered about a mile from the plant. This new deposit has been thoroughly tested. It consists of about 30 acres and runs to a depth of about 30 feet. Many screen analyses taken on this deposit show it to run about 20 per cent sand with the balance running from pea gravel to 12 inch boulders



The Bins, Screening and Crushing Plant of the Atlas Rock Company.

with about 35 per cent of this balance running from 2½ inches up. Incidentally the free gold content will run from 5 to 10 cents per ton of material excavated in this new deposit. Gold is also recovered in the old deposit of this company and has averaged more than 5 cents per ton of material excavated. While market conditions are favorable, the gravel percentage excellent and all that, several Pacific Coast producers have actually made $100.00 and more a day by recovering the gold in the deposit. It is hard to understand in view of these facts why other producers have not thoroughly tested their deposits to determine this gold content. If it is there, it can be recovered economically.

In the present plant a Marion drag line steam shovel, type 36 with a 1½ yard bucket, excavates the material and loads into Western dump cars which are transported on standard gauge railroad equipment to the plant. The haulage equipment consists of a 21 ton Vulcan locomotive and one 18 ton Plymouth locomotive. The dump car is automatic in all its actions, dumping and locking by means of air operated by the engineer on the locomotive. The time required to dump 25 tons of material in the hopper, measured from the time the locomotive comes to a dead stop, the car dumping its load, righting and locking itself and ready to start back to the steam shovel for another load, is eight seconds.

The material is fed from the bottom of the hopper to a 30 inch belt by means of a steel pan feeder. The belt, which is 251 feet between centers and at an angle of 20 degrees, elevates the material to a 60 inch Stephens Adamson cylindrical screen 24 feet long. The first section of this screen is a scrubber, 6 feet long having no perforations. Six 4 inch angles spaced equi-distant and longitudinally in the inside of the scrubber carry the material up on the inside of the screen. When they are dropped back, the force of the impact against the bottom of the screen loosens the silt and clay from the gravel. The primary washing takes place in the scrubber. Water is furnished by a 5 inch two stage Byron-Jackson pump, which furnishes 800 gallons per minute under 20 pounds pressure at the nozzle end. A 6 inch cast iron pipe line carries the water from the river to the scrubber. After the material leaves the scrubber, water is sprayed over it at various points. A final rewash is given just before the material is loaded on

Partial View of the Deposit Being Worked.

to the railroad cars for delivery.

From the scrubber the material passes to the next section of the screen, which is 14 feet long with 2¼ inch perforations. The material which is rejected on this section passes to the next section which is 6 feet long and has 4 inch perforations. The material which passes the perforations drops by gravity into the bin which feeds a 36 inch Symons vertical disc crusher. The material rejected by this section drops into the bin which feeds a 12x18 inch Farrell jaw crusher. Surrounding the 2¼ inch perforated section is a 1⅜ inch dust jacket 14 feet long. The material passing the 2¼ inch perforated section and rejected by the dust jacket, passes into the 2 inch gravel bin. The material passing the 1⅜ inch dust jacket, is passed by gravity into two sets of compound Gilbert screens. One of these compound screens consists of an inner conical section having ½ inch perforations and an outer conical having 5-16 inch perforations. The material passing the 1⅜ inch dust jacket and rejected on the inner conical screen drops by gravity into the 1 inch gravel bin. The material passing through the two outer conical screens passes over two sets of Hungarian gold riffles which remove gold and platinum leaving the sand, silt and clay to pass onto two settling tanks, from which the silt and clay is drawn off and sluiced back into the river. One log washer conveys the sand from the bottom of one of the settling tanks into a concrete sand bin; another log washer conveys the sand from the bottom of the other settling tank to a 4x6 shaker screen which produces a fine sand and a coarse sand from ⅛ inch to 5/16 inch. In case it is not desired to produce plaster sand, the sand can be passed direct into the concrete sand bin.

The crushing plant consists of a primary and secondary crusher as mentioned above. The crushed material from both the crushers is fed to a bucket elevator belt, 7x11x16 buckets, with 71 foot centers by means of which the material is elevated to a 42 inch cylindrical screen. The first section of this screen is 6 feet long with ⅞ inch perforations. Around this is a dust jacket 6 feet long having ⅝ inch perforations. Products which pass the ⅞ inch perforations and are rejected on the dust jacket drop into the ¾ inch crushed rock bin. The material which passes through the dust jacket drops into the dust bin. Material which is rejected by the ⅞ inch perforated section passes on into a section 4½ feet long having 1¼ inch perforations. Material passing through this, drops into the 1 inch crushed rock bin. The material rejected by this section passes on to a section 6 feet long having 1¾ inch perforations. The feed passing these perforations drops into the 1½ inch crushed rock bin.

Reclaiming Material from Stockpile and Loading Into Cars.

Rock rejected by this last section passes on to a section 6 feet long having 2¾ inch perforations, and that passing through these perforations drops into the 2½ inch crushed rock bin. The material rejected by this last section drops into a small bin which feeds a 20 inch conveyor belt which returns the rock to the bin feeding the Symons disc crusher.

One of the features of this crushing plant is that any one of the sections of the cylindrical screens can be blanketed. This enables the production of any size crushed rock desired. It also enables the mixing of any one or all of the sizes in any one of the bins. Another feature of the plant is that there are two 30 inch mixing belts, one of them on the sand and gravel bunkers and the other on the crushed rock bunkers. The material is fed from the bunkers onto these belts by means of rack and pinion gates on the north side of the bunkers. This allows the mixing of two sizes of sand and four sizes of gravel in any desired proportions, or it allows the mixing of any one or all of the five different crushed rock products. The flexibility of the plant is excellent.

The cars are loaded direct from the south side of each bin when only one size of material is required. Time required for loading a fifty ton car is about four minutes. The capacity of the bunkers is 1,000 tons of crushed rock and 1,100 tons of sand, gravel and cobbles.

The storage is handled by means of a 20 ton Brownhoist having a 50 foot boom and a 1½ yard bucket. The switching and moving of cars from the plant to the storage ground is performed by a 7 ton Plymouth gasoline locomotive. This has been found to be much more convenient than the locomotive crane. The fuel consumed by the Plymouth locomotive in switching and moving cars for 8 hours amounts to only 10 gallons of gasoline.

The crane, steam shovel and Vulcan locomotive are equipped with oil burners. The Pacific Gas and Electric Company furnishes electric power for two Westinghouse and four General Electric motors totalling 265 horsepower.

The capacity of the old plant was 1,000 tons per 9 hour day and fifteen men were normally employed. The new installation will increase this capacity to 2,000 tons a day with the increase in labor of about five men. The material will be excavated and transported to the plant by two trains of 12 yard Western dump cars. One train of these cars will be hauled by the 18 ton Plymouth and the other by the 21 ton Vulcan locomotive.

Mr. A. C. McMillan is president of the Atlas Rock Company. Mr. Fred R. Beerman is general manager; Mr. Walter S. Good is sales manager; and Mr. N. F. Jones is plant superintendent.

The New Anderson Diesel Engine

The Anderson Engine and Foundry Company is now manufacturing its new type KD heavy duty diesel engine. While there are no radical departures in this engine from the type K engine, it is decidedly improved in many respects. The new engine is much heavier; the crankshafts are larger and the bearing surfaces are longer. It is simplified and has more pleasing lines than the type K engine. The KD Anderson diesel engine is in every respect a most modern unit.

The Anderson type KD heavy duty diesel engine is of the two stroke cycle, cold starting, mechanical injection, diesel type. Every upward movement of the piston inhales the crank case full of air, which air is compressed therein by the next downward stroke until the inlet port is uncovered by the piston, at which time this compressed air is transferred from the crank case to the cylinder on the well known two cycle principle.

To insure long life, the parts run unusually slowly. They do not get power from high speed. Piston speeds are well within the limits of standard practice and good engineering. All Anderson engines are tested at considerable overload and conservatively rated for 1,000 feet altitude, and are guaranteed to operate safely and successfully under certain overload conditions in continuous operation.

The r.p.m. is such that it will run at synchronous speeds, thus enabling it to be direct connected to standard stock generators. The engine is as automatic and fool-proof as an engine can be built; it is sufficiently simple to be understood by the average user and will burn any fuel which can be used successfully under similar conditions by any oil engine.

Market Makes Economy Essential In This Sand and Gravel Plant

By E. D. Roberts

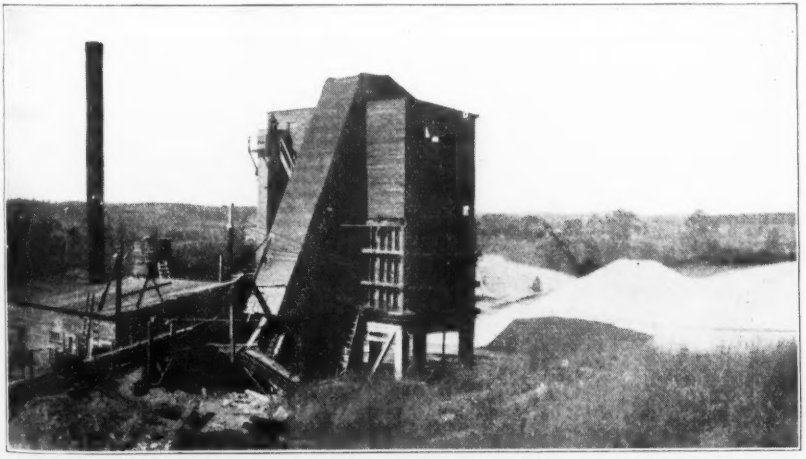
COMPETITION served in the interest of economy this summer when the State Washed Sand and Gravel Company of Milwaukee, Wisconsin, replaced its steam engines with electric equipment. Economy and efficiency have become first consideration because of the necessity of producing more sand than gravel. The gravel deposit operated by this company is located about nine miles northeast of the center of Milwaukee and about seven miles from their market. There is no railroad serving the pit, and as a result, all deliveries are made by auto truck over paved roads with the exception of a mile of macadam road from the plant.

Competition is very keen in the marketing of sand, and as the deposit runs about 60 per cent sand, efficient operation is essential if the plant is to make a profit. It is necessary to actually find a market for all of this sand as the question of storage involves ground area which is valuable for production purposes in serving any such market as Milwaukee. Gravel can be sold fairly easily, but for every ton of gravel sold one and a half tons of sand must also be sold.

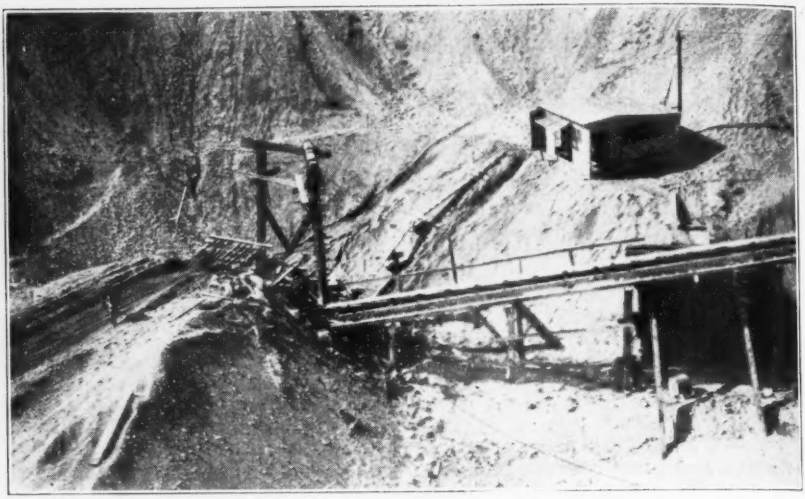
For several years the plant has been operated with 100 h.p. steam engine using steam from a 150 h.p. boiler. This steam engine has now been replaced by a 75 h.p. Allis Chalmers motor. This change has resulted in the elimination of one man and a saving in power cost.

The gravel deposit is overlaid with soil to a depth of about 6 feet. This soil is removed by a Pawling and Harnishfeger combination shovel and crane operated with gas power and a caterpillar traction. The shovel dumps the earth into dump wagons which are hauled to a waste dump on lower ground. The stripping is small compared to the depth of the pit which, at the present time, is about 50 feet and can be operated satisfactorily at a much greater depth. Another operator in the same deposit is now down 70 feet.

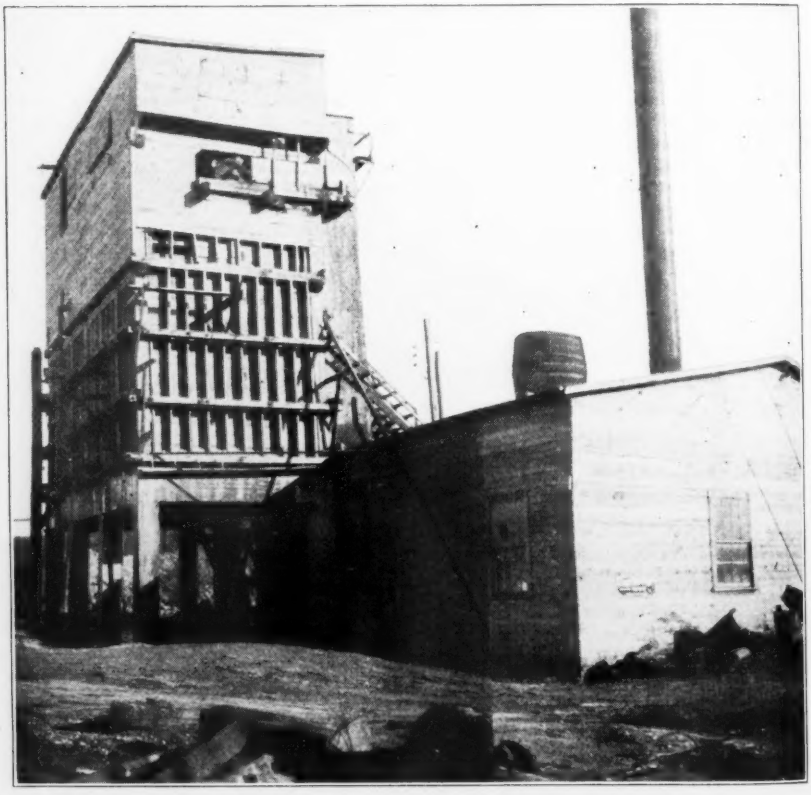
A double drum Mundy hoist is operated by an Allis Chalmers 220 volt motor with variable speed control. The material is excavated by means of a 1½ yard Green drag scraper which discharges onto a grizzly over a hopper. This hopper discharges onto an inclined 24 inch belt conveyor operating on 210 foot centers. The material is carried by this conveyor to the crushing and washing plant where it is discharged onto a fixed inclined screen which allows all material under 2 inch to fall into the boot pit of a



The Crushing Plant of the State Washed Sand and Gravel Company



The Grizzly and Discharge to Conveyor



The Storage Bins and Power House

Toepfler bucket elevator. The oversize material falls into a number 4 Gates gyratory crusher set at 1¾ inches. The discharge from this crusher is deflected down a chute into the same place where the discharge from the scalping screen fell and is carried up the elevator with the sand. The mixing of the sand and crushed rock in this way insures a clean bucket during wet weather when sand alone would be liable to stick in the buckets.

The Toepfler bucket elevator discharges into a 52 inch by 24 foot revolving Toepfler screen giving three products, namely: sand; ¼ inch to 1½ inch; and 1½ inch to 2 inch gravel. The two smaller sizes go through the screen and the larger size is rejected. Water, at the rate of 350 gallons per minute is played on the material as it enters the screen and falls through the screen with the sand. The sand and water falls into an Allis Chalmers dewaterer. This dewaterer is really a double screw conveyor operating in an inclined trough forcing the sand up out of the water. The product is a very clean sharp sand.

From the screen and washer the three sizes of material fall into separate bins constructed of wood on reinforced concrete posts and bin bottoms. The trucks draw off the sand or gravel through gates and deliver it to the trade direct from the bin. After freezing weather comes in the fall, this part of the plant is shut down until spring.

Nine 5 ton Mack trucks are owned and operated by the State Washed Sand & Gravel Company and are kept busy at all times. All of these trucks are equipped with Heil dump bodies. Several additional trucks are hired to keep pace with the demand for sand and gravel during rush periods.

The wagons used in stripping the overburden are kept busy between times in drawing off the sand and gravel and storing it in large piles for winter delivery. The P. & H. gas crane piles the material back with a clam shell bucket, later reclaiming it with the same bucket and loading the trucks for shipment.

Occasionally orders for pit run material are received and are filled directly by the gas shovel. A screen is placed on the truck bed, and the shovel loads the bank run onto the screen with a three-quarter yard dipper. The proper sized materials fall through the screen into the truck bed while the larger pieces fall to one side to be reclaimed by the drag line scraper and reduced to commercial size by the Gates crusher. Boulders rejected by the grizzly are broken up by hand during slack times and fed to the crusher by an Atlas portable conveyor.

As stated before, the original installation has been replaced by a 75 h.p. Allis Chalmers motor. This motor operates the crusher, belt conveyor, elevator, screen, dewaterer, as well as a 25 kilowatt DC generator. This generator furnishes power for operating a 25 h.p. 110 volt DC motor direct connected to a 3 inch Allis Chalmers centrifugal pump. This pump delivers 350 gallons of water per minute against a total head of 180

View of Present Working in Pit

feet to furnish water for washing the sand and gravel. The water is taken from a reservoir 29 feet in diameter and 21 feet deep. One wonders at first at the apparent waste of money; but the generator was originally operated by the steam engine, and as the two motors were installed originally, no change was made when the plant was electrified.

Power is received from The Milwaukee Electric Railway and Light Company at 26000 volts pressure. Pole transformers step down this voltage to 220 volts for operating the plant motors.

The State Washed Sand & Gravel Company is owned and operated by Mr. T. D. Francy, who also owns the State Sand and Gravel Co. This pit is adjacent to the one described above. The product of this pit is nearly all mason sand, and as the market is burdened with an excess of this product at present, Mr. Francy has shut it down rather than operate at a loss. The plant described is operated by five men including one shovel operator.

New Incorporations

Rival Sand and Gravel Corporation; Jamaica. Capital $5,000. Incorporators: P. J. and J. Madawick, P. Tulle.

Westside Cement Construction Co., Patterson, N. J. Capital, $100,000.

Synthetic Stone Co., Dallas, Texas; Capital, $10,000. Incorporators: Nick Scott, Mary Scott, John H. Bianchi.

United States Lime and Cement Corp., Dover, Del., building materials of all kinds; E. E. Craig, incorporator. Capital, $2,500,000.

Liberty Cement Blocks Corp. Capital, $15,000. Incorporators, J. F. and F. Matucci, J. Mattana.

Copemish Gravel Company, Lansing, Mich. Capital, $100,000.

Madison Sand & Gravel Corp., Hamilton, N. Y. Capital, $75,000.

Brunswick Cement Products Co., South Riverside Cement and Clay products. Capital, $100,000. Incorporators: Fred Oswald, Lucy Oswald, and Leroy Work.

Rye Chester Concrete Block and Sand Co., Rye. Capital, $30,000. Incorporators: M. B. Weir, A. W. McKay, C. H. Fuchs.

Duro Cement Block and Construction Corp. Capital, 15,000. A. and S. Berman, G. Deresi, incorporators.

Freight Car Loadings

Loading of revenue freight for the week ended on October 24 totalled 1,121,459 cars, the greatest number loading during any one week on record with the exception of the week of August 29, this year, which exceeded it by 2,977 cars according to reports filed by the carriers with the car service division of the American Railway Association.

The total for the week of October 24 was an increase of 15,345 cars over the preceding week due to increases in the loading of coal, merchandise and less than carload lot freight, miscellaneous freight, grain and grain products, coke and forest products. Decreases under the week before were reported in the loading of live stock and ore. This was the fourteenth week this year that revenue freight loadings have exceeded 1,000,000 cars.

Compared with the corresponding week last year, the total for the week of October 24 was an increase of 8,406 cars, while it also was an increase of 47,618 cars over the corresponding week in 1923. It was, however, a substantial increase over the corresponding weeks in 1920, 1921 and 1922.

A comparison by weeks follows:

	1925	1924	1923
October 24	1,121,459	1,113,053	1,073,841
October 17	1,106,114	1,102,300	1,073,095
October 10	1,106,099	1,088,956	1,075,938
October 3	1,112,462	1,077,747	1,079,775
September 26	1,120,645	1,087,954	1,097,493
September 19	1,098,428	1,076,847	1,060,811
September 12	975,434	1,061,781	1,060,563
September 5	1,102,946	920,979	928,916
August 29	1,124,436	1,020,809	1,092,150
August 22	1,080,107	982,700	1,069,915
August 15	1,064,793	1,019,077	1,062,993
August 8	1,051,611	941,407	978,750
August 1	1,043,063	945,613	1,033,466
July 25	1,029,603	926,309	1,041,415
July 18	1,010,970	990,230	1,001,350
July 11	982,809	909,973	1,019,800
July 4	864,452	757,904	850,082
June 27	901,341	908,251	1,021,471
June 20	982,600	803,546	1,005,432
June 13	987,106	902,592	1,008,838
June 6	994,874	910,793	1,012,312
May 30	920,514	986,209	820,551
May 23	986,209	918,214	1,015,532
May 16	984,916	913,201	992,319
May 9	981,370	908,213	984,078
May 2	981,711	913,550	961,617
April 25	959,225	878,387	962,578
April 18	922,778	876,916	970,042
April 11	917,284	880,937	945,271
April 4	922,375	961,990	896,375
March 28	931,395	907,389	896,735
March 21	909,363	908,290	916,818
March 14	924,149	916,762	904,116
March 7	930,009	929,381	905,344
February 28	862,910	944,544	916,624
February 21	925,295	945,679	830,187
February 14	902,877	935,589	816,646
February 7	928,244	906,017	849,352
January 31	896,055	929,623	865,314
January 24	924,254	894,481	896,464
January 17	932,150	894,851	864,297
January 10	932,807	872,023	873,908
January 3	765,727	706,292	727,246

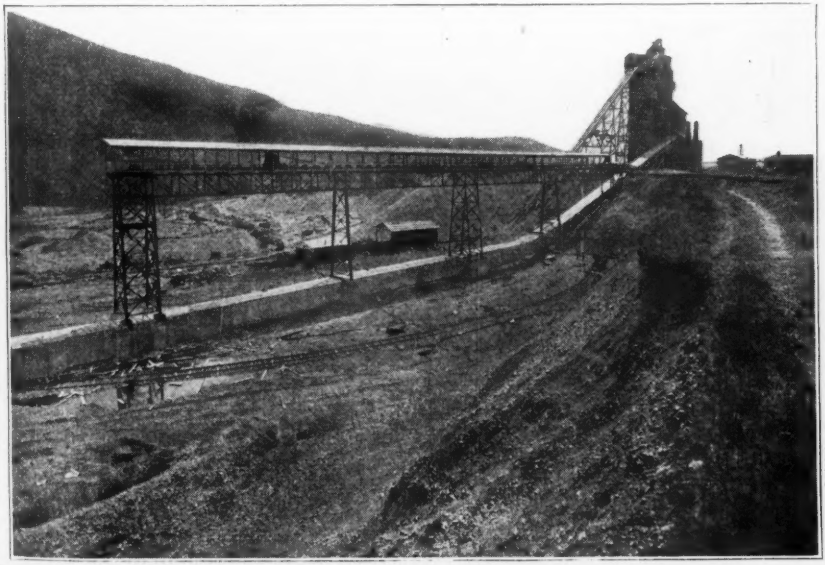
Reclaiming Materials from Storage Efficiently and Economically

DURING 1924 the Wyoming Sand and Stone Company of Wilkes-Barre, Pennsylvania, added storage equipment to its plant at Wyoanna in order that excess material could be stored and reclaimed back to the plant when necessary. The storage and reclaiming system was designed and installed by the Link-Belt Company. The system consists of a belt conveyor with an automatic tripper for dumping the sand and gravel, and a concrete tunnel running through the middle of the ground storage with a tunnel belt conveyor to reclaim the material.

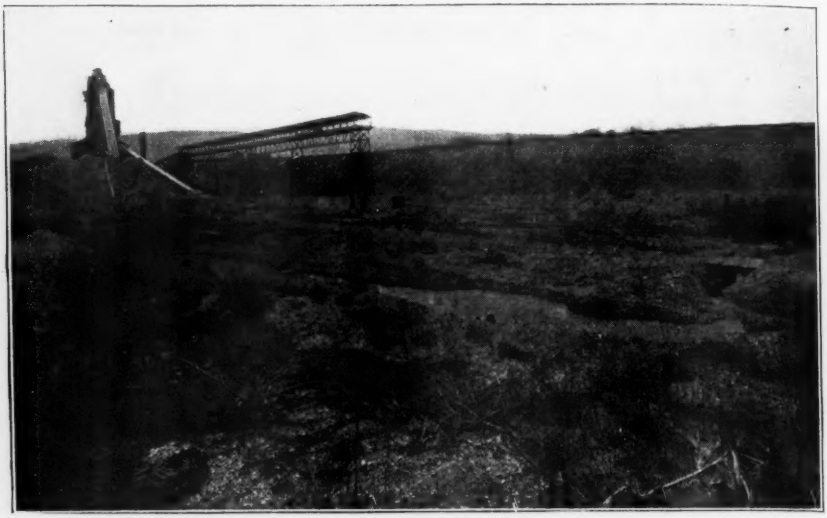
Other changes have been made during this year, and the plant at the present time is the largest and one of the most efficient in the teritory. Production averages 1,000 tons of very high grade material daily. The plant is run by steam with the exception of two gasoline locomotives and the Link-Belt storage system which is run by electricity which is generated by the Wyoming Sand and Stone Company. The material produced is generally used on such work as large bridges, state highways and general construction. The plant is located on the main line of the Lehigh Valley Railroad about twenty miles from Wilkes-Barre, Pennsylvania.

The material is loaded from the bank pit by two shovels into end dump quarry cars which are hauled to the foot of an unusually steep incline. Here the cars are hauled up by a steam cable hoist to the screening and washing plant. There are two shovels for loading material into the quarry cars. One of these is a Thew gasoline shovel with a ¾-yard bucket, and the other is a Marion steam shovel with a ¾-yard bucket. Two gasoline and one steam locomotives are used in hauling the quarry cars. There is one 7-ton Milwaukee gasoline locomotive, one 6-ton Vulcan gasoline locomotive, and one 10-ton Vulcan steam locomotive.

The material is hauled up the incline to the plant by cable and discharged into a hopper. From this hopper the material passes to the various crushers and Hummer screens and is then thoroughly washed. Four sizes of gravel and two sizes of sand are prepared. The material can be



View of Wyoming Sand and Stone Company's Plant Showing Storage Distribution System and Tunnel for Reclaiming Material

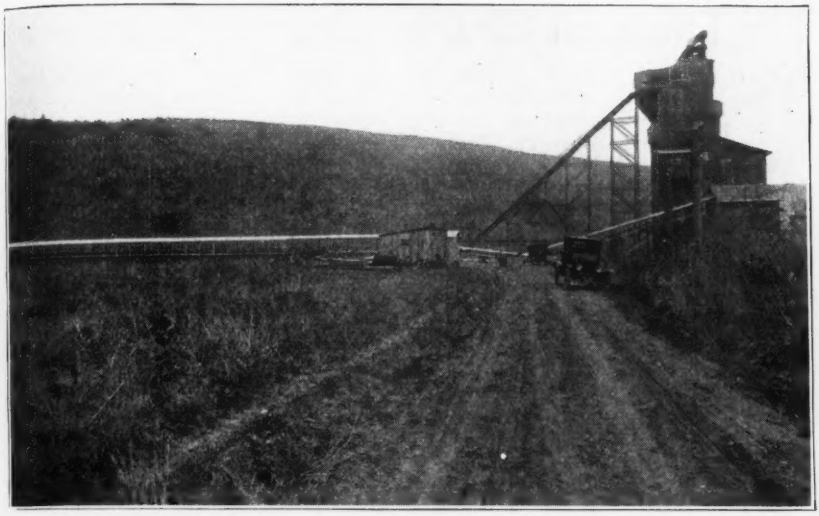


The Deposit Showing The Incline to the Crushing Plant for Quarry Cars and Also the Covered Incline for Reclaimed Material

either sent direct to the storage bins which are directly over the railroad tracks for direct shipment, or it can be sent to ground storage over the Link-Belt conveyor system which conveys by belt and discharges by automatic trippers.

Material from the outside storage can be reclaimed by the tunnel conveyor or, should the occasion demand it, could also and at the same time be loaded by the shovels into quarry cars and hauled to the hoppers. Another feature is that large quantities of material can be held in storage and reclaimed without interfering with the regular plant production. The illustrations accompanying this article show clearly the possibilities of this ground storage system. It can

The Storage Bins Directly Over Tracks for Shipment



Showing the Reclaiming Side of the Crushing Plant and Also the Highway Approach

also be seen that the overburden is very light and of little expense to handle. Railroad connections can be made with the Central of New Jersey Railroad, the Delaware and Hudson Railroad, the Delaware, Lackawanna and Hudson and the Pennsylvania Railroad. The officers of the Wyoming Sand and Stone Company include General William G. Price, President; J. P. Eyre Price, Vice President, and Andrew K. Leach, Treasurer and General Manager.

Soule and Zepp, Inc.

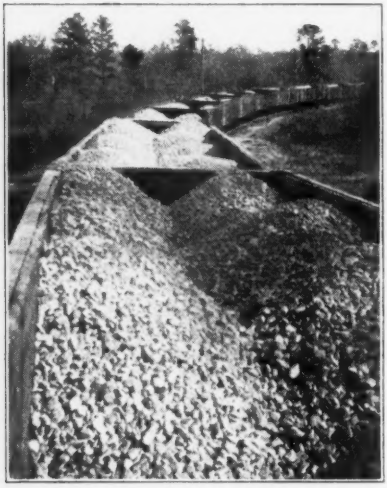
Carlton M. Soule, formerly chief engineer for The Spencer Construction Company and Levigne M. Zepp, formerly principal assistant engineer for Richard K. Meade and Company, announce their association for the practice of structural and mechanical engineering under the firm name of Soule and Zepp, Inc. Offices will be maintained at 322 North Charles Street, Baltimore, Maryland.

An Excellent View Showing the Character of the Deposit Being Worked

The Last Granite Deposit South

PERHAPS we seldom associated Macon, Georgia, with the crushed stone industry. One of the interesting crushed granite operations is conducted at Macon by the Morris Stone Company. The deposit which they operate has the distinction of being the last granite deposit south. The rock is very hard, but crushes and cubes instead of flaking. There are about 200,000,000 tons of stone available above the present quarry floor and available with practically no stripping.

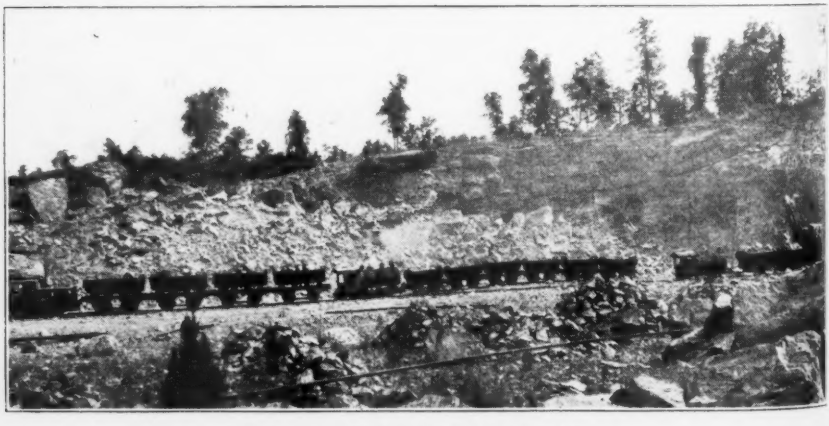
The stone is quarried with the aid of well drills, and the large stone blasted down is reduced with Ingersoll Rand jackhammers. The plant equipment is all new. The stone is loaded by a number 37 Marion shovel into eight-yard Koppel dump cars. The cars are hauled by both steam and gasoline locomotives. One Plymouth 8-ton gasoline locomotive and three steam locomotives are being used at the present time. One 20-ton steam locomotive is kept for emergency use. A 70-ton steam locomotive is used for shifting the railway cars. All of this equipment is standard gauge.



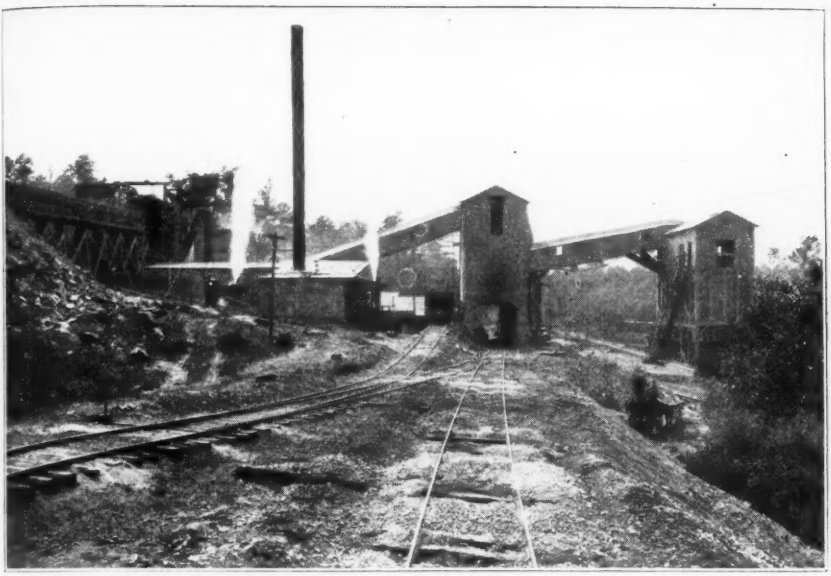
A Trainload of Crushed Granite

The stone is hauled to the crushing plant and discharged directly to a 60x48 Worthington initial jaw crusher. From this crusher the rock passes to a 20-inch McCully gyratory crusher by gravity. The discharge from the McCully crusher is to a 36-inch elevator which discharges to a 7x14 scalping screen with 2½ inch perforations. The 2½ inch stone drops into a bin, and from here the stone passes to a 24-inch conveyor belt and is conveyed to the screen house. There are two revolving screens 60 inch by 24 feet, which produce three sizes; 2¼ inch, 1¼ inch and screenings. That material which goes over the scalping screen drops into a Gates number 7½ crusher and an Austin number 6 crusher and is reduced to 2½ inches in size. From the Gates crusher and the Austin crusher the stone goes to a 24-inch conveying belt where it is conveyed back to the 36-inch elevator and to the scalping screen.

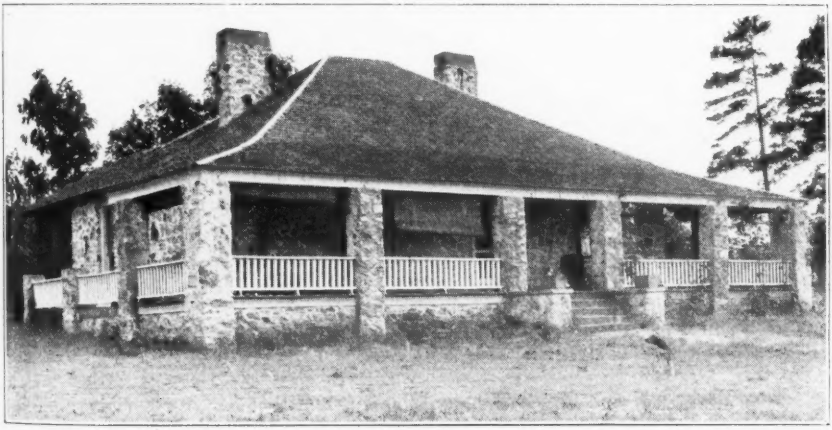
The main bins are 80 feet long, 16



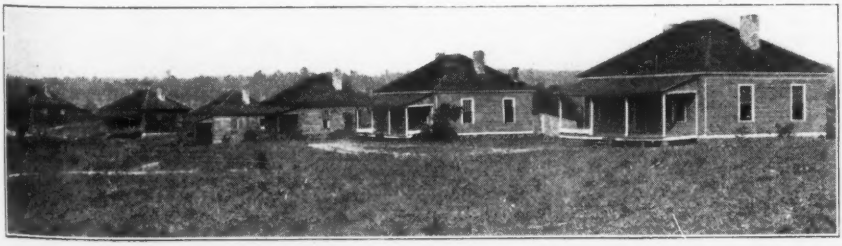
Part of the Deposit Being Worked



The Crushing and Screening Plants



The Superintendent's Home



One of the Rows of Employees Homes

feet wide and 20 feet high. At the side of the large bins there is an 18-inch conveying belt which takes the stone from any one of the bins and conveys it to a reduction crusher which crushes 300 tons of material per day down to 1 inch, or it is possible to pass all the screenings up to a conveyor which carries the stone to the new bins which are 40 feet long, 16 feet wide, and 16 feet high. Here there is a revolving screen 48-inch by 20 feet. This screen, which is all wire, produces sand, ¼ inch, ⅝ inch and 1 inch stone. At the side of the bins is a hoist and clamshell with which 10,000 tons f stone of various sizes can be stocked.

The plant is driven by steam with a water tube boiler and an Allis Chalmers corliss condensing engine of 1,000 h.p. There are three compressors which give about 2,000 feet of free air per minute. The blacksmith shop is equipped with air sharpeners and air forges. There is also a machine shop which is complete to do the necessary repair work. The Morris Stone Company intends to electrify the entire plant as soon as they can get the power.

The company owns its own railroad tracks which include six miles of track to the Central Georgia Railway lines, and three quarters of a mile to the Southern Railway lines. This arrangement assures an ample supply of cars at all times. Duplicate parts for every piece of equipment which cannot be readily secured in Macon are carried in stock. The rock is very hard, and all the crushers and wearing parts of the screens and shovels are equipped with manganese steel. The quarry and plant are operated for twelve months in the year. The plant is capable of producing 2,500 tons of stone daily, but at present the production averages 1,000 tons per day. There are some projects under consideration in this territory, however, which will shortly make it advisable for the daily production to be increased to the capacity of the plant.

One of the features of the plant is that jetty stone can be loaded with a locomotive crane at the rate of 10 to 15 cars a day, as the standard gauge cars can be run into the face of the quarry. Another feature of the plant is the homes of the employees. The company has built 46 houses, one hotel, one commissary, an office building, a garage, and a warehouse. The homes of the employees are really artistic and very comfortable.

Mr. C. A. Morris is president of the Morris Stone Company and Mr. E. L. Morris is general manager. The quarries are at Holton, and the general office is in Macon, Georgia.

Cement Plant Improvements

The Santa Cruz Portland Cement Company is spending more than a half million dollars improving its Davenport, California, plant. Four 10-foot grinding mills, four sets of Allis-Chalmers rolls and Hummer screens are being added.

The Acme Corporation will spend one million dollars for a program which will practically reconstruct their plant at Catskill, N. Y. The firm of McClellan and Junkersfeld of New York City has been retained as engineers. The concrete work will be handled by the Turner Construction Company of New York City.

The Olympic Portland Cement Company will install another kiln at its plant at Bellingham, Washington. The plan is to increase the present capacity to 3,000 barrels daily.

The Edison Portland Cement Company will construct a concrete packing house and a concrete bag house at its plant at New Village. The contract has been awarded to the Public Service Production Company of Newark, N. J.

The Huron Portland Cement Company has arranged for the construction of a pack house and storage silo to double the present capacity. The Burrell Engineering and Construction Company of Chicago has been awarded the contract. The Burrell Engineering Company is building silos, a raw storage plant and a laboratory building at the present time for the Nazareth Cement Company at Nazareth, Pa.

The Warrior Cement Corporation has awarded a contract to the Bland Engineering Company of Indianapolis, for the erection of six concrete storage silos and a packing plant at the Demopolis, Alabama, plant.

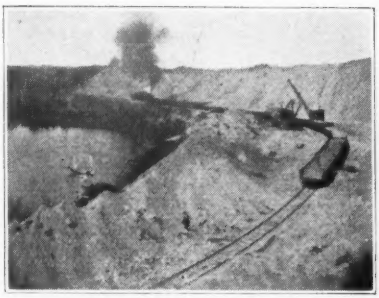
The Power Equipment Company, 315 Third Ave. North, Minneapolis, is now representing Foote Bros. Gear & Machine Co. of Chicago, on their industrial gears, spur, worm and herringbone speed reducers.

A Typical Canadian Aggregate Plant

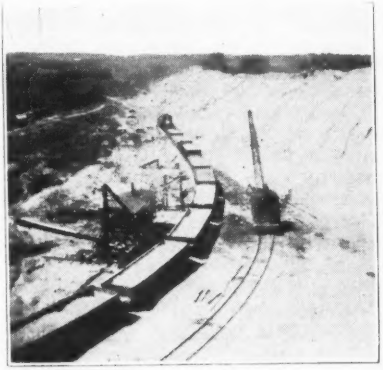
TWELVE years ago the Bonner Sand and Ballast, Limited opened up a sand and gravel deposit at South Durham, Drummond County, in the Province of Quebec, Canada. This deposit was on the Canadian National Railway. A standard gauge railway was built a distance of about three quarters of a mile from the plant to the pit. A traveling derrick with a one cubic yard clamshell bucket was installed to load the material into a field hopper. The material was then loaded from this hopper into the cars and hauled to the plant. This deposit varied in depth from grade to 90 feet in elevation. It also surrounded a small spring lake. The overburden of loam and shrub ran from six to fifteen inches. This overburden was removed with drag scrapers and one or two teams.

Early in 1924 the Bonner Sand and Ballast, Limited, installed a 20-ton Browning locomotive crane and equipped it with a 1½-yard Mead Morrison type W grab bucket. This equipment increased the plant capacity to 1,500 tons per day. Material was then loaded into the field hoppers or to cars direct. This season the company installed a small washing and screening plant for preparing concrete sand, concrete gravel and fine road gravel for highway maintenance.

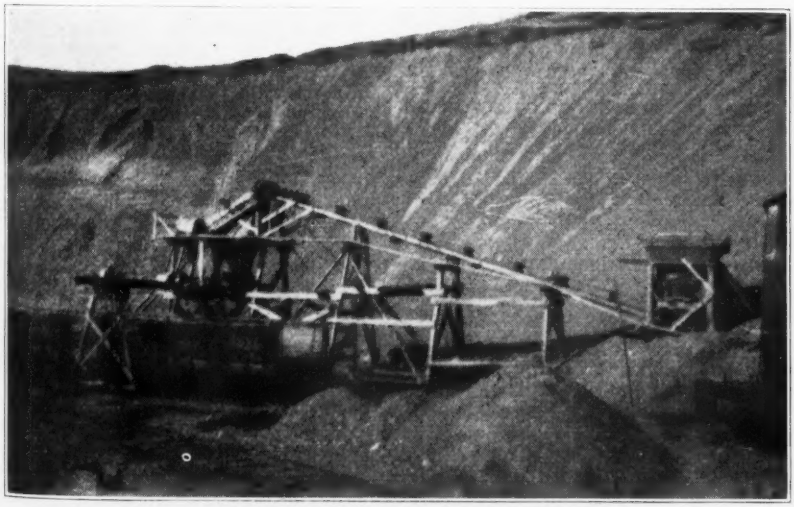
At the present time the gravel is



View Showing Lake in Center of Deposit



Ballast Material Being Loaded Directly Into Cars



View in the Pit Showing the Loading System for Concrete Aggregate

Locomotive Crane Loading From Bank

loaded by the Browning locomotive crane into a hopper. The material is fed from the hopper to a short 18-inch belt conveyor set at an angle of 20 degrees. This conveyor discharges the material to a shaking screen. The oversize falls into a pile and is rehandled by the Browning crane. The graded material goes to a second conveyor set at right angles to the first and is discharged directly into the railway cars for shipment. This arrangement handles 30-tons per hour. The power is supplied by three gasoline engines with an aggregate of only 10 h. p. A crusher is needed to reduce the oversize, and one will be installed soon. The larger tonnage produced is loaded directly from the pit to cars and shipped for ballast, etc., without grading or washing. Fortunately, the pit runs seams very pure and clean. However, specifications will some day make it necessary for the Bonner Sand and Ballast, Limited, to screen and wash all of its product. All material for concrete aggregate and fine road work is screened and washed, while that material shipped for ballast is not.

The plant is handled by ten men. Shipments are made over both the Grand Trunk and the Canadian National Railways. F. H. Carlin is president of the company, and W. J. Daly is superintendent in charge of the plant.

An illustrated folder, describing the American EEFD general service centrifugal pump operated by the "New Way" engine, has been issued by the American Well Works, Aurora, Illinois. The ordinary capacity in field operation is 70 to 250 gallons per minute; at 150 foot head the pump delivers 120 gallons per minute.

A New Conveyor Carrier

Belt conveyors have for many years been in general use and are not new, but the Sacon Belt Conveyor Carrier built by the Stephens-Adamson Mfg. Co. has established a new record for popularity. Immediately upon the announcement of this Sacon Carrier with its new construction it was recognized as a distinct accomplishment in advanced design. The Sacon is a three-pulley type carrier. The three-pulley type of carrier establishes itself as a correct carrier and many instances have confirmed this fact such as its adoption and successful operation on the longest conveyor installation in the world. The Sacon is equipped with high grade ball bearings that carry the roll shafts which rotate with surprising ease and effect an unusual power economy. All bearings are fitted for high pressure lubrication. Sturdy malleable iron stands are mounted on the rigid horizontal angle tie. Pulleys and bearings are easily removed for inspection. All parts are interchangeable.

The Sacon Belt Conveyor Carrier

Bay City Dredge Exhibit

The Bay City Dredge Works has shipped a Model 16-B convertible crane-excavator with steel cab and skimmer and ditcher attachments, also a Model 4 One-Man excavator with shovel, clamshell and dragline attachments, to San Francisco for exhibition at the All-Western Road Show, to be held in San Francisco commencing November 9th. The exhibit will be in charge of Mr. J. P. Sherbesman, newly appointed West Coast representative, and following the Road Show, the machines will be kept in Mr. Sherbesman's warehouse as Pacific Coast stock.

The Non-Metallic Mineral Industries Only Authoritative Reference Book

PERHAPS you have had the experience of searching for some specific information or data on methods, practices, tables, etc., as relates to the non-metallic mineral industries. Then again you may have found a little of what you wanted from one source and some more from two or three sources. This condition will probably be relieved for practically every problem by referring to only one source, the new 1926 edition of the PIT AND QUARRY Handbook. Never until now has a complete authoritative reference book for the non-metallic mineral industries been available. The new 1926 edition of the PIT AND QUARRY Handbook meets the need by concentrating between two covers trustworthy information on the numberless practical problems involved in operating a plant engaged in the manufacture or production of cement, lime, gypsum, crushed stone, sand and gravel and the other non-metallic minerals. Nowhere else in one handy volume can you find such a wealth of useful information on the non-metallic mineral industries.

The Editorial Staff

This new edition was prepared under the direction of H. W. Munday, who in addition to contributing to the book itself, coordinated and arranged the contributions of eighteen able contributors. As Editor of PIT AND QUARRY, Mr. Munday is in touch daily with the problems of the non-metallic industries. In preparing the new edition of the Handbook, Mr. Munday has had the help of eighteen able contributors of whom twelve assisted as associate editors. It has been necessary to assemble, compose and organize a great mass of material. Those principles and practices which have proved reliable have been carefully studied.

Mr. G. B. Massey, one of the contributors is also an Associate Editor of PIT AND QUARRY and is probably the foremost authority on problems relating to excavation, particularly as they apply in the hydraulicking and dredging fields. He is the author of a book entitled "Engineering and Excavation," published by John Wiley and Sons in January, 1923. Incidentally, this book has had a very wide circulation. Mr. Massey has spent practically all of his time studying excavating problems and the application of machinery and equipment to them. He has studied operations and designed plants in Russia, Sweden, Norway, England, Scotland, Wales, France, Cuba, Panama, Alaska, Mexico, India, Siam, Canada, and a large part of the United States. He is a graduate engineer of the Sheffield Scientific School of Yale University. He is a member of the A. S. C. E., A. S. M. E., and W. S. E.

Virgil Marani another contributor is probably the foremost authority on gypsum. In his work as Chief Engineer for the Gypsum Industries he has been of valuable assistance to the Gypsum Industry. He is a graduate of Toronto University and a member of several engineering societies and engineering committees.

Harvey S. Owen as Chief Engineer of the Western Lime and Cement Company has studied closely those problems related to the manufacture of lime. Mr. Owen is recognized as an authority on hydration and burning. His work is well known to the Lime Industry.

Mr. E. D. Roberts, another able contributor is also an Associate Editor of PIT AND QUARRY, has had thirteen years' experience in cement plant design and construction and in the highway field. Before his present connection with PIT AND QUARRY, he was associated in the design and construction of the Sun Portland Cement Company's plant at Lime, Oregon. He is a graduate of Oregon State University and, in addition to his present connection with PIT AND QUARRY, serves as Professor of Civil Engineering at Marquette University, Milwaukee, Wisconsin. Mr. Roberts enjoys membership in the A. S. C. E. He has just returned from an extensive trip, visiting all the important operations on the Pacific Coast, and his articles concerning these operations which appeared in PIT AND QUARRY have attracted considerable comment.

Mr. R. N. Van Winkle, another contributor, also writes extensively for PIT AND QUARRY, and because of his experience as owner and manager of two crushed stone quarries at Cedar Rapids, Iowa, is particularly well qualified to understand problems involved in crushed stone operations. He was graduated an engineer from Purdue University, and soon after became affiliated with the France Stone Company, with whom he spent seven years holding various executive positions in charge of operations. His recent series of articles, published in PIT AND QUARRY, concerning blasting methods in open pit mines and quarries, have been widely quoted.

Mr. C. H. Sonntag, another associate, also contributes to practically every number of PIT AND QUARRY. He has had more than twenty years' experience in the actual operation and management of the Marquette Portland Cement Company's plant at Cape Girardeau, Missouri. During the past several months Mr. Sonntag has visited many of the cement plants of the East and South with a particular object in mind of accumulating data on problems for discussion through the medium of PIT AND QUARRY. Probably there is no better qualified engineer in the Cement Industry today.

Mr. F. A. Westbrook, another contributor, is also the Eastern Editorial Representative of PIT AND QUARRY, and spends all of his time in the field visiting the various operations in the East that are assigned to him. One of his articles appears in every issue of PIT AND QUARRY. He is a graduate engineer, holding a degree of M. E. from Columbia University, and up until his present connection with PIT AND QUARRY, was Chief Engineer for Harbishaw Electric Company.

Mr. Charles Longenecker, another contributor, is a recognized expert on all problems relating to combustion. He is a graduate engineer of Pennsylvania State University and has had fifteen years of engineering experience with such companies as Bonnot Company, Fuller-Lehigh, and Combustion Engineering Corporation.

Mr. Joseph H. Donnell is a recognized authority on problems of transportation and traffic. At the present time he is Traffic Counselor for LaSalle Extension University. During the past year he has been studying the transportation problems of the non-metallic mineral industries. Mr. Donnell studied transportation at the University of Georgia and has had a wide experience both in association with railroads and shippers.

Mr. D. J. Hutchinson is a graduate of the Business Course of Harvard University and in his practice as a consulting accountant has studied financial problems of the crushed stone and the sand and gravel industries.

Mr. Dwight Ingram is a fire protection engineer of broad experience. He received hs business degree from Harvard University and for the past several years has been associated in inspection, fire prevention, rate classification, etc.

A description of the sections in the new edition of the PIT AND QUARRY Handbook will give an idea of the un-

usual practical quality of the information contained.

Section 1—Geology—E. D. Roberts

The origin and formation of sands, gravels and rocks—The occurrence and distribution of sands, gravels and rocks—The chief characteristics of various sands, gravel and rocks—Constituents of sands, gravels and rocks—Properties of non-metallic minerals—Examination and testing of non-metallic minerals, etc.

Section 2—Plant Designs—E. D. Roberts, G. B. Massey, and H. W. Munday.

Prospecting and valuation of deposits—Locating and laying out plants Types of plants—Flow of material—Laying out the quarry Industrial track systems—Building Construction Drainage, etc.

Section 3—Stripping—G. B. Massey.

Methods of stripping—Use of scrapers, dragline excavators, shovels, etc., in stripping—Disposal of stripping, etc.

Section 4—Drilling and Blasting—R. N. Van Winkle.

Types of drills—Use of drills—Explosives—Blasting—Secondary blasting—Air compressors—etc.

Section 5—Loading and Transporting G. B. Massey.

Methods of loading and transporting material from the pit or quarry to the mill—Shovels—Scrapers—Draglines — Tramways — Gravity — Quarry carts—Rails—Railway systems—Lifts—Portable belt conveyors—Portable loaders—Bucket elevators—Belt conveyors—Tunnel systems—Tower excavators, etc.

Section 6—Crushing—C. H. Sonntag.

Primary and secondary crusher—Rock crushing—Crushing sand and gravels—Types of crushers—Types of rolls—Feeding crushers—Foundations—Duplicate units—Removing tramp iron, etc.

Section 7—Grinding and Pulverizing—C. H. Sonntag.

In general—In cement mills—In gypsum mills—In lime mills—Ball mills—Tube mills—Automatic Feeders, etc.

Section 8—Elevating and Conveying—C. H. Sonntag.

Methods of elevating and conveying in the mill—Types of elevators and conveyors—Feeding elevators and conveyors—Discharging—Inclined elevators and conveyors—Driving elevators and conveyors—Capacities—Belt conveyors — Bucket elevators — Casing elevators and conveyors, etc.

Section 9—Screening and Separating—H. W. Munday.

Methods of screening and separating the non-metallic minerals and their products—Classifying with water—Classifying with air—Types of screens—Speed of rotation—Arrangement of screens—Feeders—Dust proof casings—Dust collecting.

Section 10—Washing and Drying—H. W. Munday.

Methols of washing and drying—Wash mills—Cone washers—Sedimentation—Filtration—Centrifugal drying — Evaporation — Sluicing — Retaining separators—Deflecting separators.

Section 11—Storing, Rehandling and Miscellaneous Handling—C. H. Sonntag.

Methods of storing and rehandling—Open storage—Storage bins—Rehandling—Bagging or sacking—Trucking—Type and uses of such miscellaneous handling equipment as overhead cranes, derricks, hand operated hoists, lift trucks, etc., in the non-metallic industries.

Section 12—Dredging—G. B. Massey.

Methods of dredging—Types of dredges—Power for dredges—Harbor regulations.

Section 13—Pumping—G. B. Massey.

Pumps and their applications in the non-metallic industries.

Section 14 — Hydraulicking — G. B. Massey.

Hydraulicking methods in sluicing, excavating and stripping in the non-metallic industries.

Section 15—Power Plant Operation—C. Longenecker.

Combustion — Heat — Fuels — Gases — Economizers — Feed water heaters — Boilers — Stokers — Engines — Turbines — Compressed air—Condensers.

Section 16—Powdered Coal—C. Longenecker.

Powdered coal and its application in the non-metallic industries.

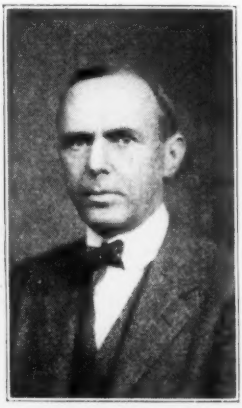
Section 17—Power Transmission—G. B. Massey.

A Reference Volume of Tremendous Scope

The Editorial Board of the 1926

H. W. Munday
G. B. Massey
F. A. Westbrook
C. H. Sonntag
R. N. Van Winkle
J. H. Donnell

H. W. MUNDAY



G. B. MASSEY

E. D. ROBERTS

R. N. VAN WINKLE

The Non-Metallic Mineral Industries

H. W. Munday, Editor, Assisted by

Prepared With Assistance of Able Contributors

Edition of Pit and Quarry Handbook

Virgil Marani
E. D. Roberts
D. J. Hutchinson
H. S. Owen
C. Longenecker
Dwight Ingram

VIRGIL MARANI

H. S. OWEN

J. H. DONNELL

F. A. WESTBROOK

Handbook of Authoratative Information

Eighteen Contributing Specialists

Belt — Chain — Gear — Direct — Rope, etc. — Drives — Motors — Speed reducers — Bearings — Ball bearings, etc.

Section 18—Burning—C. H. Sonntag.

Methods of burning in the cement, lime and gypsum industries—Types of kilns—Fuel consumption—Kiln economies—Kiln fuels.

Section 19—Cement Cooling, Grinding and Storage—E. D. Roberts.

General methods of clinker cooling —Pan conveyors—Rolls—Steel Belt—Sprinkling—Types of Coolers—Packing and storage.

Section 20—Waste Heat Recovery—C. H. Sonntag.

Principles and application of waste heat recover to the manufacture of cement.

Section 21—Hydration—H. S. Owen.

The manufacture of hydrated lime —Processes—Theory.

Section 22—Lubrication—F. A. Westbrook.

Lubrication in the non-metallic industries.

Section 23—Specifications and Tests—H. W. Munday.

Tests of rock, gravel and sands—Specifications for Portland cement—Road material specifications—Highway department specifications.

Section 24—Statistics—H. W. Munday.

The latest statistics on production, shipments, prices, etc., on the non-metallic industries, at the time of going to press.

Section 25—Directory of Associations.

Tabulation of associations in the non-metallic industries showing officers and headquarters.

Section 26—Cost Accounting—D. J. Hutchinson.

Definition—Relation to general accounting—Methods of cost accounting —Departmentalization — Elements of cost—Accounting for material—Material requisition — Accounting for labor—Accounting for burden—Chart of expense accounts—Job cost burden distribution—Disposition of final cost figures and cost of sales.

Section 27—Appraisals—H. W. Munday.

Appraisal forms and use in the non-metallic industry—Their relation to income tax, insurance, costs, etc.

Section 28—Insurance—Dwight Ingram.

Property insurance—Coinsurance—Fire—Riot — Explosion—Windstorm —Flood—Engine breakage—Liability insurance—Workmen's compensation —Public liability—Steam boiler—Robbery, etc.

Section 29—Fire Prevention—Dwight Ingram.

Method of fire prevention as applied to non-metallic industries—Equipment and its use in fighting fire.

Section 30 — Accident Prevention—R. N. Van Winkle.

Quarry safety orders — Accident safeguards—First aid—Injuries and their treatment.

Section 31—Shipping Data—J. H. Donnell.

The industrial traffic department—Factors to be considered in freight rates—Duties of traffic department employees—Rules of practice before Interstate Commerce Commission—Car demurrage — Rules — Diversion and reconsignment rules—Miscellaneous freight forms, etc.

Section 32 — General information—H. W. Munday.

Tabular and statistical matter of a general character that cannot be conveniently placed in any of the other sections. In general, all tabular matter. such as statistics, tables and formulae will be classified in some definite section, if possible.

In every detail the 1926 Edition of the PIT AND QUARRY Handbook has been edited to save the time of all who use it. The publishers tender the 1926 Edition of the PIT AND QUARRY Handbook for service to the non-metallic mineral industries.

Clinchfield Adds Third Unit

Contracts have been awarded for the installation of a third unit at the Clinchfield Portland Cement Corporation's Plant Number Two located at Clinchfield, Georgia. This will include an additional rotary kiln 175 feet in length and 10 feet in diameter. Work will proceed on this new unit at once as it is hoped that it will be in operation by April of 1926. With the addition of this third unit the capacity of the plant will be increased to 1,000,000 barrels per year.

ear Sir:-

Please send the one copy of the 1926 Edition of the PIT d QUARRY Handbook which is sent free to each company enga- d in the production or manufacture of non-metallic minerals to:

mpany _____

ddress _____

dividual _____ *Title* _____

Also please enter orders for ( ) additional copies at $5.00 ch, for the following individuals in our organization:

_____ _____

_____ _____

_____ _____

POST CARD

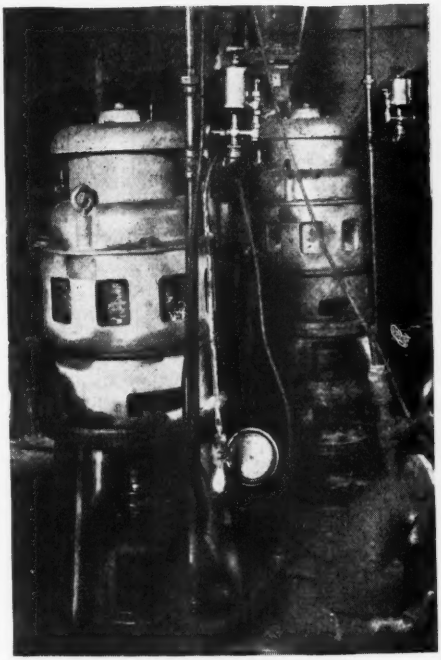
2c
Stamp

Editor,
PIT and QUARRY Handbook
Room 907, Rand McNally Bldg.,
CHICAGO, ILLINOIS

MORRIS SLURRY PUMPS

In Another Big Cement Mill

IN the new one-million-barrel-per-year plant of the Standard Portland Cement Co., Painsville, Ohio, the slurry is pumped to the grinding mills, from the grinding mills to the correction tanks, and from the kiln basins into the kiln feed tanks by Morris Electric-motor-driven Slurry Pumps. At each of these three pumping stages, the Morris Pump installations are in duplicate, the second unit being held in reserve. The motors of a typical one of these sets are shown in the photograph.



The handling of slurry is the hardest pumping work in any cement mill, and because of the gritty nature of the particles is one of the severest tests to which a pump can be subjected.

That Morris Pumps have been chosen for many new and prominent cement plants is good evidence of their reliability for hydraulic handling of sand, gravel, crushed rock, etc.

Write for Bulletin 20

Morris Machine Works **Baldwinsville, N. Y.**

Originators of Centrifugal Pumps, both single and multi-stage, and builders for practically all purposes since 1864

Branch Offices: New York, 39-41 Cortlandt St.; Philadelphia, Forest Bldg.; Cleveland, Engineers' Bldg.; Chicago, 217 N. Jefferson St.; Boston, 79 Milk St.; Pittsburgh, 320 Second Ave.; Detroit, Penobscot Bldg.; Charlotte, Realty Bldg.; Richmond, 708 Mutual Bldg.; Houston, 119 Main St.
Sales Representatives: Buffalo, St. Paul, Kansas City, Denver, Salt Lake City, Seattle, Portland, Ore., Los Angeles, New Orleans.

MORRIS
CENTRIFUGAL PUMPS

The Texrope Drive

An important development in the field of power transmission machinery has just been announced by the Allis-Chalmers Mfg. Co., who have recently perfected an entirely new type of short center, flexible drive, known as the Texrope Drive. The Texrope Drive consists of two grooved sheaves and a number of especially constructed endless "V" belts. The sheaves are set just far enough apart so that the belts fit the grooves without either tension or slack.

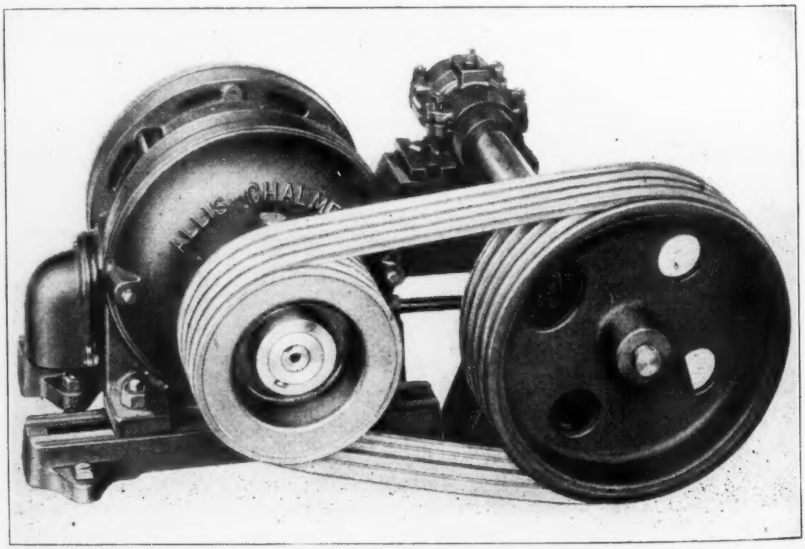
Previously no short center drive existed which did not have slip, back lash or lost motion, which caused jerky starting and uneven running. Since the Texrope belts just fit the sheaves, there is no slack or lost motion in the drive. Because of the "V" construction, they cannot slip, as the harder the pull the more firmly the belts grip the grooves. Being elastic and stretchable, they cannot jerk, either in starting, acceleration or running, nor can they transmit vibrations, but act as cushions between the driving and driven machines. Therefore smoothness of transmission never attained before is delivered by the Texrope Drive, as opposed to the series of linear pulsations delivered by the ordinary short center drive.

Bearing pressures are low, since no belt tension is employed. The drive occupies very little space. It is silent, perfectly clean, unaffected by moisture or dirt, and is safe, simple and trouble proof. Since there is no slip, the speed ratios are fixed and exact. It is durable, and each belt carries its proportional share of the load.

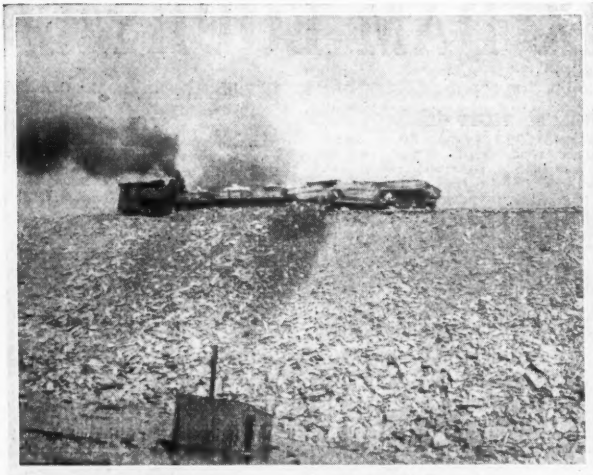
Texrope Drives from ½ to 250 horse power, with ratios up to 7 to 1 and belt speeds from 800-6000 feet have already been placed in service. They have been applied to nearly every industry, notably textile machinery, fans and blowers, machine tools, food manufacturing machines, refrigeration, mining, crushing, wood and metal working machinery, elevators and conveyors, paper, flour and rubber mill drives, etc.

An International Road Show

That the next annual good roads convention and exposition of the American Road Builders' Association to be held in Chicago January 11-15, 1926, inclusive, will be an international and especially a Pan-American affair, is indicated by the fact that all the Central and South American countries are being asked to send delegates. Last year among the 16,000 registered delegates in attendance at the convention were many from South America in an unofficial capacity.



Exhibition Model Allis Chalmers Texrope Drive



This Western Dump Car Train Unloaded in Nine Seconds

Speed was what they wanted. Speed was what they got! Six Western dump cars discharged big, tough loads—look at the size of that rock—in nine seconds and were on their way back for more.

But even more important than the wide openings and steep dumping angles that enable Western dump cars to handle tough stuff with ease; even more important than their swift, positive action, is their rugged dependability, time-tested and service-tested on thousands of demanding jobs.

Western dump cars are available in all sizes from 1½ yards to 50 yards. We shall appreciate an opportunity to tell you more about them. Get our catalog P-61.

Western

SUCCESSFUL PERFORMANCE

Western Wheeled Scraper Company

Founded 1877

Earth and Stone Handling Equipment

AURORA, ILLINOIS

"DIX DAM EQUIPMENT"

May be inspected at Burgin, Ky., 20 miles from Lexington, Ky.

STEAM SHOVELS

3—78-C Bucyrus, 1923 model, 30-ft. boom, 19-ft. dipper stick, 3-yd. dipper, two on railroad trucks, one on caterpillar. Shop Nos. 4001, 4124 and 3995.

LOCOMOTIVES

2—Porter, standard gauge, saddle tank, cylinders 14x22, weight 42 tons, only one year's service, like new. Shop Nos. 6770, 6853.
4—Porter, 36-in. gauge, 18-ton, saddle tank, cylinders 10x16, rebuilt like new. Shop Nos. 4619, 4667, 6748 and 6804.

CARS

20—Continental 4-yd. 36-in. gauge, 2-way dump cars.

DRILLS

4—Keystone Drills, 1 No. 5½; 3 No. 3½.
14—Denver Rock Drills, 6 No. 21; 8 No. 31.
3—Tripod Drills, 2 Ingersoll-Rand; 1 Sullivan.
1—D to 64 Sullivan Column Drill.
5—Ingersoll, Calyx Drills, with power, 3 class G-31; 2 Class GO 2843 and 2844.

JACKHAMMERS

35—Jack Hammers; Ingersoll-Rand D.C.R. 13, 23 and 430; Sullivan D.D. 33 and Hardscog No. 60.

COMPRESSORS

2—Sullivan steam driven Compressors, 1 capacity 1,500 ft.; 1 capacity 950 ft.

GASOLINE AND ELECTRIC HOISTS AND DERRICKS

F.O.B. Chicago, Philadelphia and Pittsburgh Large quantity American double drum Hoists, with attached swinging gear, capacity 6,000 lbs. on single line at 162 ft. per minute, with new 55 H.P. Climax gasoline engine, or 37 H.P., AC, 60 Cycle, 3 phase electric motor, or 35 H.P., D.C., 220 volt motor, or without power for belt drive.

Large quantity Stiff Leg Derricks with booms 14x14x50, 60, 70 or 80 ft., mast legs and sills in proportion, with bullwheel for hook line or bucket operation.

Stock List No. 102 Lists All Equipment—Write For It.

Equipment Corporation of America

Philadelphia	CHICAGO, ILL.	Pittsburgh
660 Land Title Bldg.	1460 Roanoke Bldg.	860 Empire Bldg.
Phone Rittenhouse 5498	Phone Randolph 6586	Phone Grant 5148

REBUILT EQUIPMENT

LOCOMOTIVES, STEAM SHOVELS, CRANES, CARS, COACHES, RAIL, ETC.

LARGE ASSORTMENT IN STOCK
Completely Rebuilt in Our Own Shops

Southern Iron & Equipment Co.
EST. 1899

ATLANTA GEORGIA

FOR SALE

3 Bucyrus Railroad Type Steam Shovels
Models 95-B, 70-C, 70-ton

1 Bucyrus Revolving Steam Shovel
Model 18-13

1 Davenport Saddletank Locomotive
20-ton Standard Gauge

1 60 KW. General Electric A. C. Generator
1200 R.P.M., 3 P., 60 c., 2300 v. on cast iron bed plate direct connected to

1 Van Blerck Gas Engine
6 Cylinder Type L. C.

2 No. 7½ Crusher Elevators 65′ Centers
24″x10″x11¾″ buckets, 17″ Jeffrey Patnoe Chain

THIS EQUIPMENT IS ATTRACTIVELY PRICED

The Dolomite Products Company
Maple Grove, Ohio

MACHINERY FOR SALE

CRUSHING ROLLS

Two 16"x10", One 12"x24", Three 30"x10", Two 36"x16", Two 42"x16", and One 24"x54" Crushing Rolls. Swing hammer mills and other types.

GYRATORY CRUSHERS

Two No. 3 Gates, One No. 4 Gates, Two No. 5 Gates, Two No. 6 Gates & McCully, Two No. 7½ Gates and Austin, Three No. 8 Gates & Traylor, One No. 9 Gates Gyratory Crushers.

JAW CRUSHERS

Three 9"x15", One 10"x20", Two 12"x24", One 15"x30", One 18"x36", One 24"x36", One 36"x42", and One 22"x50" Jaw Crushers.

ROTARY CRUSHERS

Three No. 1, Two No. 1½ and One No. 2 Sturtevant Rotary Fine Crushers.

DRYERS

Two 3'x20', Three 4'x30', One 4½'x30', One 5'x40', Three 5½'x40', Two 6"x60', and One 7'x60' Direct Heat Rotary Dryers. One 5'x25', One 6'x30', Two 8'x8' Ruggles Coles type "A" and one 4'x20' Ruggles Coles type "B" Double Shell Rotary Dryers.

KILNS

One 4'x40', One 5'x50', Two 6'x60', One 6'x125', One 7'x60', One 7½'x80' Rotary Kilns.

SWING HAMMER & TUBE MILLS

Fuller, Griffin, Hardinge and Raymond Mills.

W. P. HEINEKEN & CO., Inc. — **Industrial Engineers**

95 Liberty St., New York City, Tel., Hanover 2450

BABBITS—ARMATURE METAL—PIG LEAD

Tin: Spelter (zinc); Die-Cast Metal; Ez-Flo Solder; Special Alloys made to specifications.

Write, wire or phone for prices and information.

KANSAS CITY WHITE METAL CO.

Mfrs. & Smelters

(Kaw Station) Kansas City, Kans.

Phone Victor 9243

For Sale or Rent

LOCOMOTIVE CRANES

1—Browning 21 ton 8 wheel 50' boom—used only one month.
1—McMyler 30 ton 8 wheel 75' boom—overhauled.
1—McMyler 15 ton 8 wheel 50' boom—first class.
1—Industrial 10 ton 4 wheel 38' boom—overhauled.
1—Byers Crane 19' gauge.
1—Peerless Crane 14' gauge.

STEAM SHOVELS

1—Type "B" Erie on caterpillar.
1—Type "B" Erie with crane attachment on caterpillar.
1—14B Bucyrus on caterpillars.
1—18 Osgood on caterpillars.
1—Model 20 Marion, RR trucks.

CLAMSHELL BUCKETS

4—New Power Wheel Blaw-Knox ¾ yard.
1—New Bull Dog Blaw-Knox ¾ yard.
1—1-yard Williams.

LOCOMOTIVES & TRACK

3—7 ton 24" gauge Whitcomb gasoline.
3—10x16—4 wheel Saddle Tank Porter.
2—9x14—4 wheel Saddle Tank Vulcan.
3 mile 24" gauge Industrial Track.

Hoisting Engines, Derricks, Road Rollers, Concrete Mixers, Batch Boxes 24 and 36" gauge, Cars, Pumps, Grout Machines and Concrete Chute.

Everything for the Contractor and Road Builder.

PITTSBURGH MACHINERY & EQUIPMENT CO.

1302 Fulton Building, Pittsburgh, Pa.

T. H. LETSON CO.

Good Used Equipment — **Hudson Terminal Bldg. NEW YORK** — **Clean Business Methods**

STEAM SHOVELS

1—¾-yd. type B Erie high lift, traction wheels.
1—¾-yd. type B Erie No. 1566 on Caterpillars.
1—¾-yd. type B Erie No. 1769 on Caterpillars.
1—¾-yd. Al Thew on Traction Wheels.
1—No. 4 Keystone Excavator No. 4296, with skimmer scoop and trench bucket.

HOISTS (Steam)

1—7x10 single drum, Skeleton Lidgerwood.
1—8½x10 three drum and boiler Lambert.
1—10x12 D. D. and Swinger Skeleton Lidgerwood.

HOISTS (Electric)

1—22 H.P. two drum Flory with 2Ph. 60C. 220V. Motor and Solenoid brake.
30—Separate Clyde Electric Swingers with 10 H.P. 3Ph. 60C. 220V. Motors, or without Motors.

DERRICKS

1—10 ton 80' boom 14"x14" Terry Timber Stiff Leg with 12' Bullwheel.
1—20 ton 70' boom Steel Guy (Erector's type.)

BUCKETS

2—½-yd. Handler Type Lakewoods.
1—¾-yd. Handler Type Lakewood.
1—1-yd. Digger Type Lakewood.
1—1½-yd. Class E Hayward.
1—¾-yd. Page Dragline.
1—1¼-yd. Page Dragline.

DREDGES and SCOWS

1—12-in. Centrifugal Pump Dredge.
1—1½-yd. Marion Dredge.
1—2½-yd. Marion Dredge.
1—4 -yd. Marion Dredge.

You May Be Sure of—

SERVICE—which is assured by our conveniently situated distributing points

QUALITY—which is backed by the following guarantee:

"All material is sold subject to being satisfactory upon arrival, otherwise we will take same back at our own expense."

PRICE—which can be easily determined

BY WRITING

MORRISON & RISMAN COMPANY, INC.

Buffalo **New York**

RAILS

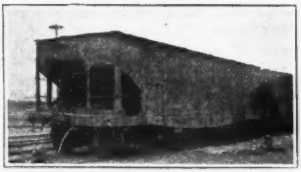
00 NEW RELAY 00

MANUFACTURERS OF

PORTABLE TRACK

FOR SALE

600—50-Ton All Steel Double Hopper Cars.
(400 have rolled steel underframes and 200 have pressed steel underframes)



Complete specifications upon request

BRIGGS & TURIVAS (Inc.)

110 South Dearborn Street, Chicago, Illinois

Railroad Cars and Equipment
Freight Car Parts
Relaying Rails and Fastenings

Scrapped Iron in all Its Forms
New Iron and Steel
Industrial Plants and Equipment

RAILS LOCOMOTIVES CARS

Any quantity, any size of new and relaying rails available any time from the nearest of our four great yards. **Inspected, guaranteed.** Quick delivery at lowest freight cost.

Locomotives of every type in I. C. C. condition. Road, Switch, Geared, Standard and Narrow Gauge. Write for specifications.

Hyman-Michaels Co.
Peoples' Gas Bldg., Chicago

Passenger, Dump, Ore, Box, Flat, Refrigerator, Hart Convertible Cars, Gondolas, Cabooses. All in serviceable condition. Will pass interchange. Ready to ship.

NEW YORK ST. LOUIS PITTSBURGH DALLAS SAN FRANCISCO

3—3½ YD. SHOVELS

Railway Type, Mang. Dippers

Crushers #10, 9, 8, 7½, 6, 5, 4, 3,

Roll Crushers

84x72, 36x60, 54x24, 18x30

Jaw Crushers

22x52", 36x42", 42x48", 20x24", 15x36"

DISC CRUSHERS. 48", 36", 24", 18"

OIL ENGINES

50-75-100-200-500-650 H.P.

Kilns, Pulverizers, Air Comps.

2—200 H.P. MOTORS S RING

440 v., 60 cy., 3 ph., 435 rev., G. E.

Ross Power Equipment Co.

13 South Meridian St., Indianapolis, Ind.

CRUSHERS

1—36"x48" Traylor Jaw.
1—No. 9 Gates, manganese fitted.
1—No. 8 Gates, chilled iron fitted.
3—Symons Disc, 48", 24" and 18".
1—24"x36" Farrell.
2—24"x36" Carroll, manganese fitted.

SHOVELS

1—Marion Model 37 Electric.
1—Marion Model 32, caterpillar.
1—Erie, type B, combination.
1—Marion Model 28, two booms.

CRANES

1—22 ton O. & S. with 50 ft. boom.
1—Northwest Model 105, combination shovel and crane.
1—O. & S. 7 ton, gas, caterpillar.
1—10 ton Byers, traction.
1—10 ton O. & S. traction, 40 ft. boom.

BOLL MACHINERY CO.

140 So. Dearborn St., Chicago, Ill.

FOR SALE CHEAP

1—20-25 ton Industrial Locomotive Crane, D.D., A.S.M.E. boiler, 50-ft. boom, 8 wheel. Can be seen in operation now.
1—Vulcan 26 ton saddle Tank Standard Gauge Locomotive—12x16.
1—D.D. Meade-Morrison Hoisting Engine, 8¼x10.
1—Lidgerwood double drum Hoisting Engine 8¼x10 A.S.M.E. boiler new 1924, used 2 months.
1—¾ yd. Haiss Clam Shell Bucket.
3—Stiff Leg Derricks; bucket operation.
1—Hayward 4-Leaf O.P. Bucket, ¾-yd. cap. New.

HARRY C. LEWIS

156 Market St., Newark, N. J.

Mitchell 3678

1—I-R Compressor—1190 ft.—Belt Dr.
4—36 in. Gage Electric Locomotives.
1—Byers "BEAR CAT" Crane.
1—Thew Shovel ¾ yd. Cat. Tr.
2—4 Drum McMyler Shaft Hoists.
1—7E Dake Hoist, 30 H.P.
5—12 yd. Std. Gage Dump Cars.
5—4 yd., 36 in. Gage Dump Cars
1—10 Ton Buffalo—Springfield Roller
1—3½ Ton Tandem Roller
18 in. and 24 in. Conveyor Belt and Idlers.
2—28-S Ransome Concrete Mixers.
1—Tank Wagon.
12 in. and 14 in. Centrifugal Pumps.
1—Marion 21 Shovel ¾ yd. Cat. Tr.
Derricks, 2 and 3 Drum Hoists.

J. T. WALSH

500 Brisbane Bldg., Buffalo, N. Y.

CABLEWAY

800 ft. span cable way complete with Lambert engine.

HOISTS

5½"x8" American D.C. D.F.D. with boiler.
7"x10" D.C. D.F.D. with boiler.
8¼"x10" Lidgerwood D.C. D.F.D. with boiler.
7¼"x10" Mundy with boiler (New).
8¼"x10" Mundy with boiler (New).

AIR COMPRESSORS

550 cu. ft. Ingersoll-Rand belted.
350 cu. ft. Ingersoll-Rand steam-driven.
8"x8" belted.

MAGNETIC SEPARATOR PULLEY

24"x26" Cutler-Hammer direct current 110 volts.

CLAMSHELL BUCKETS

2—2½ yard Browning.

WM. C. JOHNSON & SONS MACHINERY CO.

1211 N. 12th St. St. Louis, Mo.

CRANES

1—TYPE B ERIE, full revolving Steam Crawler Crane. Shop No. 2600 new late 1923, ALL STEEL CATERPILLARS, A. S. M. E. boiler; 40-ft. crane boom, bucket operating; like new.
1—20-ton, 8-wheel, OHIO, Type "CD" Locomotive Crane, Shop No. 3631, new 1924, A. S. M. E. and Mass. boiler; 50-ft. boom; double drums, M. C. B. trucks used four months, guaranteed perfect condition.

DUMP CARS

36—4-yd. 36-in. gauge, WESTERN, two-way side Dump, new 1923, Heavy Duty, 4-pedestal, STEEL DRAFT BEAMS, box Girder, Doors overhauled, first-class condition.

Grey Steel Products Company

111 Broadway New York, N. Y.

REBUILT EQUIPMENT

1—No. 4½ Champion Jaw Crusher. Price, $750.00.

1—9x15 Blake Jaw Crusher. Price, $650.00.

1—No. 3 McCully Gyratory Crusher. Price, $750.00.

THE DAY & MADDOCK COMPANY

West 82nd St., South of Denison Ave.

CLEVELAND, OHIO

AIR COMPRESSORS

92 ft. Ingersoll-Rand, ER-1, Belted.
355 ft. Ingersoll-Rand, ER-1, Belted.
355 ft. Ingersoll-Rand, FR-1, Steam
528 ft. Ingersoll-Rand, ER-1, Belt.
599 ft. Ingersoll-Rand, Imperial XB-2, Belted.
888 ft. Ingersoll-Rand, Imperial XB-2, Belted.
1190 ft. Ingersoll-Rnad, Imperial XB-2, Belted.
1145 ft. Chicago Pneumatic OCB, Belt.
1400 ft. Chicago Pneumatic, OCB, Belt.
1500 ft. Ingersoll-Rand, Imperial XB-2, Belt.
1270 ft. Chicago, OCE Motor Driven, 3 phase, 25 cycle, 440 volt.
1308 ft. Chicago, OCE Motor Driven, 3 phase, 60 cycle, 2200 volt.
6—212 ft. Chicago Portable Oil Engine Driven Compressors.
Portable Gasoline Driven Compressors.

PITTSBURGH PNEUMATIC MACHINERY CO.

507 Liberty Ave., Pittsburgh, Penna.

CRUSHERS! CRANES! SHOVELS!

CRUSHERS

One No. 21 Gates K, used but little.
One No. 12 Gates K, used two years.
One No. 20 McCully, used six months.
One No. 8 Gates K, used two years.
One No. 10 McCully, used five years.
One No. 7½ Gates K, almost new.
One No. 6 Gates D, good condition.
One No. 5 Gates K, this is new.
One No. 4 Gates K, used six months.
Two No. 3 McCully, fine condition.
One 42x48" Traylor, manganese fitted.
One 36x24" Farrell B, manganese fitted.
One 36x30" Farrell B, manganese fitted.
One 36" Symons Disc Crusher, late style, perfect condition.
One 24" Symons Disc Crusher, late style, perfect condition.
Also a lot of others.

CRANES AND SHOVELS

One Byers Auto Crane Gasoline, great bargain, good as new.
One Northwest Gasoline with shovel attachments.
One Erie B Steam Shovel, good as new.
One Marion 21 Steam Shovel, perfect condition.
One Marion 36 Steam Shovel, perfect condition.
One Bucyrus 50 B Steam Shovel, almost new.
One Bucyrus 80 B Steam Shovel, two years old.
One 70 C Bucyrus R. R. Shovel, 2½ yard.
One 70 Ton Bucyrus R. R. Shovel, 2½ yard, great bargain.
Also a lot of others.

Ask for my prices on any of the above and I feel sure you will be satisfied. I am going to move some of these quickly if price will do it. If you don't see what you need, ask me anyhow.

GEO. C. MARSH

Telephone Harrison 5745 — 1613 Great Northern Bldg., Chicago, Ill.

Will trade land or pay for following equipment in 7 per cent 10 year debentures:

Gates or Austin No. 8 crusher (Gyratory)
Kritzer hydrator
Two stage compressor (large)
125 H.P. Corliss Engine
70,000 feet re-lay rail any size over 20-lb. and under 60-lb. with splices, bolts, etc.
Set of crushing rolls
What have you? Where is it located?

Apex Engineering Company
Rookery Bldg., Spokane, Washington

FOR SALE

1—100 H.P. Bigelow H.R.T. boiler.
1—Cookson feed water heater.
1—Hewes & Philips simple Corliss engine.
1—Belt driven Crocker-Wheeler 220 Volt D.C. Generator.
1—30 ft lift Hydraulic Elevator.
Sundry power transmission.

PITTSBURGH PLATE GLASS COMPANY
P. O. Box 168, Newark, N. J.

RAILS

All sections, new and second hand rail; also portable track. Centrally located. Also Cars of all kinds.

Immediate shipment guaranteed

M. K. Frank
Union Trust Bldg., Pittsburgh, Pa. — Park Row Bldg., New York City

FOR SALE—DRAGLINE

Completely equpiped with 60-foot tower. Flory engines and boiler. Sauerman bucket with cables. In good condition at a bargain.

PORTAGEVILLE BLUE STONE CO.
Olean, N. Y.

RAILS New and Relay

ALL WEIGHTS AND SECTIONS
FROGS, SWITCHES, TIE PLATES

S. W. LINDHEIMER
38 S. Dearborn St., Chicago, Ill.

RAILS

New or Relay
Any Quantity—Immediate Shipment

ZELNICKER IN ST. LOUIS
Steel Ties—Frogs—Switches, Etc.

50 Ton Capacity HOPPER BOTTOM STEEL ORE CARS

A-1 condition. Ready for service. Bargain.

DULUTH IRON & METAL CO.
Duluth, Minnesota

A Fractional HP Motor or a Complete Power Plant

SAVE 35 to 45%

Buy Properly Rebuilt Electrical Power Equipment

Every machine completely overhauled and tested — Guaranteed

Write for Stock Bulletin

The FUERST-FRIEDMAN Co.
CLEVELAND, OHIO

Steam Auto Crane

Byer's No. 3 with caterpillars under derrick end, 30 ft. boom, ¾-yd. bucket. Used 3 months. (Cost $5,165). Sell $1,250 on cars. A real bargain.

NEWTON & HILL, Fort Edward, N. Y.

BARGAINS

4—60-ton Consolidation type Locomotives, Fine cond.tion. Price $9,500.00 each.
1—42-ton Geared Locomotive. Price $4,800.00.
6—80,000 gallon capacity tank cars. Fine condition. Price $650.00 each.
1—Latest style Jordan Spreader Car. Price $12,500.00.
6—60,000 lb. capacity Flat cars. Price $325 each.
1—20,000 lb. capacity Traveling Steel Derrick. Price $4,000.00.

Let us have your inquiries for steam shovels, cars, rails, cranes, in fact, all kinds of equipment.

MILLS EQUIPMENT CORPORATION Chattanooga, Tenn.

BARGAIN

New 25 Lb. Rail

Lackawanna Manufacture
Standard Drilled

16½-ft. lengths. Perfect condition. Car lots, $24 per ton. Less than car lots, $25 per ton.
F. O. B. Schnectady, N. Y.

St. Lawrence Trading & Supply Company
100 Fifth Ave., New York City

HEAVY CRUSHING ROLLS
We Own and Offer for Sale

One set of Sturtevant 36"x16" Balanced Type CRUSHING ROLLS in good condition with spare parts. Located Northern New York State

HOOPER-MOMBERGER CO.
Room 1703, 90 West St., New York, N. Y.
Phone Rector 2919

FOR SALE

4—Sturtevant Ring Roll Mills

For further particulars address

NATIONAL CEMENT CO.
Ragland, Ala.

FOR SALE

1—Sullivan Channeling Machine Class y-8.
1—Ingersoll-Rand Channeling Machine Class H-8.
1—24 inch Plymouth Locomotive.

THE SMALLWOOD-LOW STONE CO.
404-405 Bethlehem Bldg., Fairmont, W. Va.

For Sale
10 Ingersoll-Rand X-70
Rock Drills
50% of new price

ARCHER ARMSTRONG, INC.
Grand Central Terminal Bldg.
New York City

FOR SALE

One Croker-Wheeler Condenser, 625 K. V. A., 720 R. P. M., 440 Volts, 60 Cycle, 3 Phase, Separately Excited.

CLINCHFIELD PORTLAND CEMENT CORPORATION
Kingsport, Tennessee

FOR SALE

1—No. 7½ Austin Crusher, chilled iron fitted.
1—Model 60 Marion Shovel No. 1493.
1—Model 80 Marion Shovel No. 801.
1—Model 70 Bucyrus Steam Shovel.
1—Model "O" Thew Revolving Shovel.
1—1-yd. Vulcan Revolving Shovel.

THE CASPARIS STONE COMPANY
302 Yuster Bldg., Columbus, Ohio

WANTED TO BUY

Used spider and hopper for a No. 6 standard McCully crusher. State price and full particulars in first letter.

STOCKBRIDGE STONE CO.,
Stockbridge, Ga.

FOR SALE

1—Marion Dragline No. 28 with three-quarter yd. bucket. Complete with tank wagon, cable and jack. Machine is in good condition and can be inspected at any time at our plant. Shop No. 3856.

SIBLEY CEMENT CO., Sibley, Ia.

FOR SALE
2 BAY CITY MACHINES

1-yd. cap. Can be seen in operation. Early delivery. Located in Missouri. Also 2-yd. Sk'd and Roller.

MONIGHAN STEAM DRAGLINE

Nearly new.

W. J. GLEASON CO., Bragg City, Mo.

FOR SALE

2 American R. R. Ditchers, in good working order, capacity 7,500 pounds each, with clam shell buckets, pile driving attachment and steam shovel attachment.

DETROIT & MACKINAC RAILWAY COMPANY
East Tawas, Michigan

FOR SALE

1—Nearly new Smith Excavator, a dragline, gas driven, portable, at less than ½ price.
1—Haiss bucket wagon loader, 220 A. C. motor driven, wheel type, excellent condition, new chains and sprocket wheels. Priced to move quick.

FRED E. JENS
Colonial Hotel, Milwaukee, Wis.

FOR SALE AIR COMPRESSORS

1205 cu. ft. Ingersoll-Rand, compound steam, 2-stage air, 100 lb. pressure; complete unit mounted on cast iron subbase which also contains inter-cooler. $1500.00. First-class condition.

A. G. SCHOONMAKER & SONS, Inc
30 Church St., New York City

BURRELL
Engineering & Construction Co.
Jackson and Canal St.
CHICAGO, ILL.
DESIGNERS & BUILDERS
CEMENT STORAGE
PACK HOUSES, ETC.

ENGINEER WANTED

to direct an open cut mine. He should be experienced in steam shovel and blast hole drill operation, able to plan daily ore requirements, figure ore reserves, make progress maps, etc. Apply stating experience, age, salary expected, etc., to **Box 111, Pit and Quarry, 538 S. Clark St., Chicago.**

FOR RENT OR SALE

Type B Erie Shovel, high lift, caterpillar, ¾-yd. Fine condition. Delivered Memphis, St. Louis, Cincinnati, Louisville, Chattanooga, Lexington or Knoxville, $7100.00. Reasonable terms or will lease with option to buy.

DEMPSTER EQUIPMENT CO.
Dempster Bldg. Knoxville, Tenn.

BUSINESS OPPORTUNITY

I have a large granite quarry for crushing proposition and want to get in communication with an experienced operator for crushed stone plant. I want party to finance 50% of same and to assume entire management. Will put quarry in free gratis.

B. F. COGGINS
Candler Bldg. Atlanta, Ga.

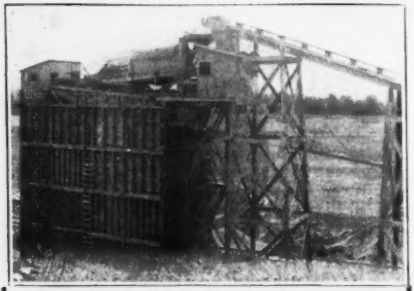
POSITION WANTED

Superintendent with 10 years' experience in design, erection and operation of sand and gravel plants desires permanent connection. Thoroughly familiar with all types of machinery and can handle all classes of labor. Have made special study of problems involving removal of clay balls, coal, shale, etc. and preparation of material to meet specifications of Bureau of Public Roads. Address Box 110, Pit & Quarry, 538 S. Clark St., Chicago.

Why Don't You Sell Out

Equipment that You Have No Further Use For?

Someone of the thousands of other plants in the country might be wanting just what you do not want. Advertise it in PIT and QUARRY. Send us a description of the equipment you want to sell, and we will tell you promptly how much advertising space you should use and what it would cost you. No obligation on your part whatever.



ECONOMY, SIMPLICITY AND DURABILITY are the chief characteristics of **RELIANCE** equipment. Complete crushing, screening and washing plants ranging in capacity from 50 to 1500 Tons Per Day.

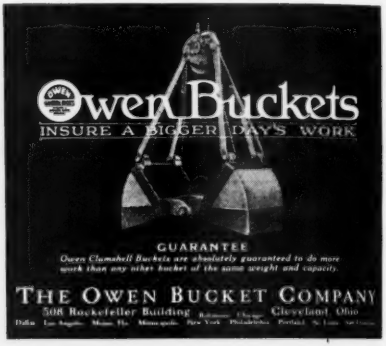
Send for Catalogue and Prices

Universal Road Machinery Co.
KINGSTON, N. Y.
Boston—141 Milk St.
New York—114 Liberty St.
Chicago—Peoples Gas Bldg.
"RELIANCE—Best in the Long Run"

HYDRAULIC DREDGES
6" to 12"

Designed and Built

RANDOLPH-PERKINS COMPANY
38 South Dearborn Street
CHICAGO



Perforated Metals and Screens of All Kinds
Material in Stock
Prompt Shipment

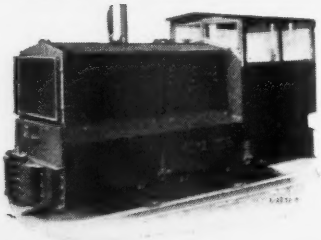
Chicago Perforating Co.
2435 West 24th Place
CHICAGO, ILL.
Tel. Canal 1459

QUARRY CAR EQUIPMENT

THE ATLAS CAR & MANUFACTURING CO.
Cleveland, Ohio

St. Mary's Oil Engine Co.
St. Charles, Mo.
Manufacturers of Diesel Oil Engines from 9 H.P. up to and including 120 H.P.

Milwaukee Gasoline Locomotives
For Industrial Haulage

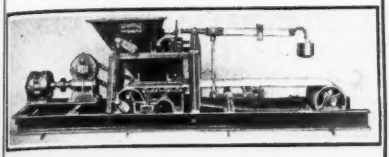


Built in sizes from four to eighteen tons. For all Gauges of Track.
FOUR SPEEDS—GEAR DRIVE
There's a reason for every purpose.
Write for catalogs M-129 and M-136
MILWAUKEE LOCOMOTIVE MFG. CO.
Milwaukee, Wis.

NO SPRINGS

No delicate contrivances, yet a machine is not obtainable that will weigh more accurately than

THE POIDOMETER



Weight against weight is the principle upon which it operates, and it is distinctly automatic in action.

Enables materials to be handled continuously or in bulk as desired.

Catalog sent on request

SCHAFFER POIDOMETER CO.
2828 SMALLMAN STREET
Pittsburgh, Pa.

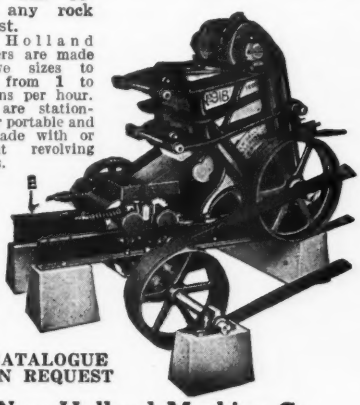
FOR ECONOMY CHOOSE

New Holland

SWING JAW CRUSHER

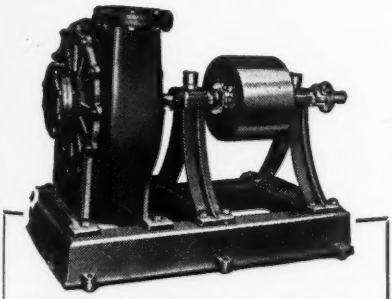
The New Holland Crusher presents an economical, efficient method of fine crushing and recrushing. They are of the Swing Jaw Type and equipped with New Holland recrushing rolls, will reduce any rock to dust.

New Holland Crushers are made in five sizes to crush from 1 to 12 tons per hour. They are stationary or portable and are made with or without revolving screens.



CATALOGUE ON REQUEST

New Holland Machine Co.
Franklin St., New Holland, Pa.



350 TONS A DAY

That's what the Vaughan Sand Company of Lumber City, Georgia, said when they wrote us Sept. 3, 1925. Following is an excerpt from their letter:

"Our six inch sand pump, bought of you about ten months ago, has been run almost every day and is still loading at the rate of 300 to 350 tons per day.

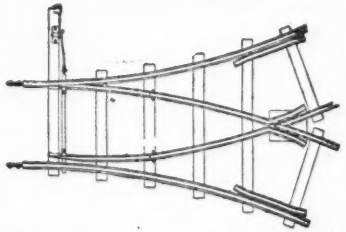
The LIGHTNING PUMP

KANSAS CITY HAY PRESS CO.
KANSAS CITY, MISSOURI

Kilby Frog and Switch Company

Birmingham, Alabama

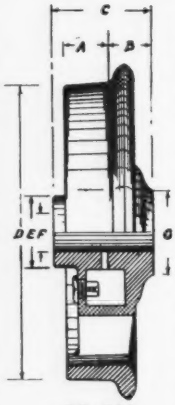
Manufacturers of



We make a specialty of track material for all kinds of Industrial Tracks—such as Frogs, Switches, Switch Stands, Rail Braces, Crossings, Crossovers, Room Turnouts, Portable Track, Etc.

Write for Catalogue.

EGYPTIAN QUARRY CAR WHEELS



NO. 100

are true to design and endure the most rough and abusive handling.

Style No. 100 has a large oil cavity so that the wheels are well supplied with oil without continuous attention, and the Spring Oilers permit the oiling to be done promptly and efficiently.

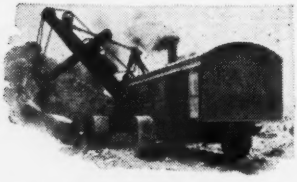
EGYPTIAN IRON WORKS
MURPHYSBORO, ILL.

Dippers For Steam Shovels

Have you seen or used a **Tisco** one-piece dipper? Correct from an engineering standpoint, carefully constructed, and from **Tisco Manganese Steel.**

To Be Sure Use Tisco.

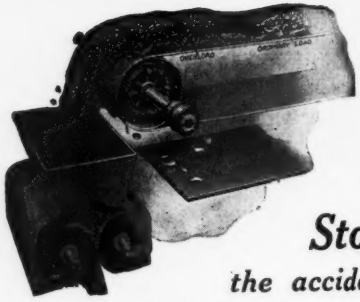
Taylor-Wharton Iron & Steel Co.
HIGH BRIDGE, N. J.



OSGOOD
Continuous Treads and Traction Wheels for Railroad Shovels
Ask for Bulletin 247
It shows actual installations
Revolving and Railroad Shovels

OSGOOD
Marion-Ohio

HIGH DUTY Magnetic Separators



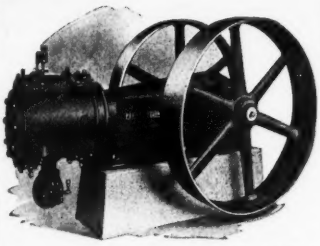
Stop the accident before it happens!

Your luck and your "careful watch" over the material you crush won't give you 100 per cent protection! If your crusher tries to masticate just one chunk of tramp iron, it will knock you out of more than the cost of a High Duty Magnetic Pulley.

This inexpensive magnetic device with its ventilation feature—which increases the magnetic power 25% to 50%—provides perfect safety even with peak loads.

Offices in principal cities. See telephone directory

MAGNETIC MFG. CO.
201—24th Ave. Milwaukee, Wis



PENNSYLVANIA

AIR COMPRESSORS

meet every demand of the most exacting service conditions. In their design, construction and materials nothing has been spared which would make them better compressors. Every installation, carries with it the assurance of satisfactory performance over a long period of minimum cost of maintenance.

Ask for bulletin 123-P

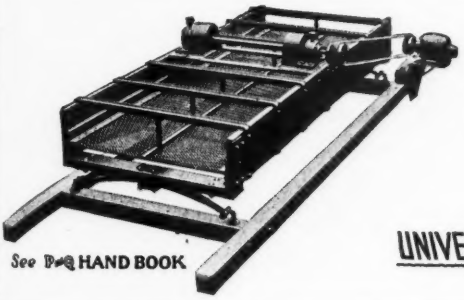
PENNSYLVANIA PUMP & COMPRESSOR CO.
MAIN OFFICE AND WORKS, EASTON, PA.

For Separating Dry Ground Materials
80 Mesh to 350 Mesh

GAYCO CENTRIFUGAL SEPARATORS

Six Sizes—30 Inch to 14 Feet Diameter

RUBERT M. GAY COMPANY, Inc. 114 Liberty St., N. Y.



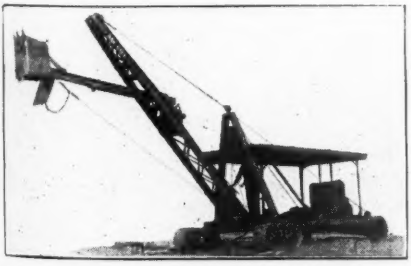
See P&Q HAND BOOK

Universal Vibrators

For the very highest screening efficiency with the lowest maintenance cost.

Write for Descriptive Catalog Today

UNIVERSAL VIBRATING SCREEN CO.
RACINE - - WISCONSIN



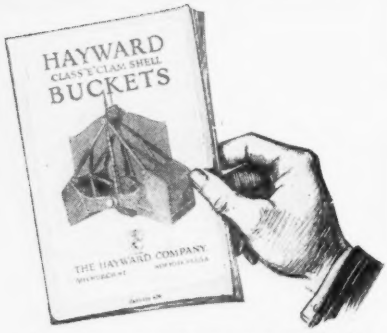
BAY CITY ONE MAN EXCAVATOR

Operates Shovel—Clam—Dragline ½-Yd. Capacity

Fills the gap between hand labor and high priced equipment. Several hundred in operation, gasoline or electric power.

BAY CITY DREDGE WORKS
BAY CITY, MICH.
See P&Q HAND BOOK Page 333

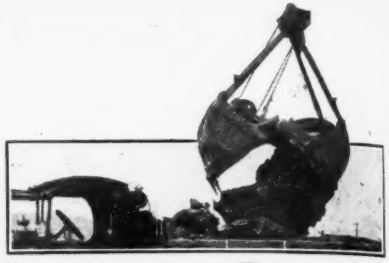
Hayward Buckets



Another new Hayward Bulletin. This pocket size bulletin completely describes three types of Hayward Clam Shell Buckets. Just ask for Bulletin 650.

THE HAYWARD COMPANY
54-56 Church St. New York, N. Y.

Builders of Clam Shell, Orange Peel, Drag Line and Electric Motor Buckets; Dredging, Excavating, and Coal Handling Machinery; Counterweight Drums; Automatic Take-Up Reels.



Dreadnaughts are Everywhere

You'll find Blaw-Knox Dreadnaughts railroading; contracting; road building; in steel mills—wherever clamshell work is being done.

Rehandling and digging costs are *lower* when Blaw-Knox Buckets are on the job.

BLAW-KNOX CO.
Farmer's Bank Bldg.
Pittsburgh, Pa.

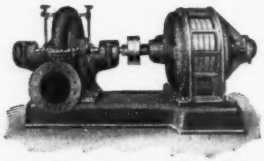
BLAW-KNOX BUCKETS

No Counterweights!

All the weight is built right into the bucket—you get DEPENDABILITY when you use a WILLIAMS. All parts guaranteed against breakage, as long as the bucket is used on the classes of work for which we recommend it.

G. H. WILLIAMS COMPANY
605 Haybarger Lane, Erie, Pa.
Eastern Sales Office: 30 Church St., New York City

WILLIAMS
FAST-DIGGING BUCKETS
All Parts Guaranteed Against Breakage



Single Stage High Head High Efficiency Centrifugal

Capacities 25 to 4,000 Gallons per minute.

Pumps for All Purposes
ECONOMY PUMPING MACHINERY CO.
Offices, 88-120 No. Curtis St., Chicago, Ill.
Works, 91-111 McDonough St., Joliet, Ill.

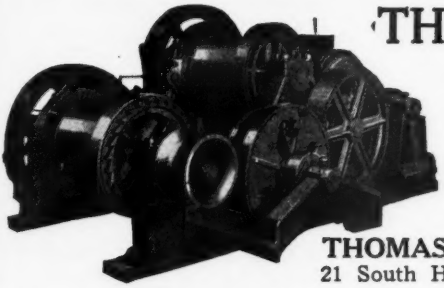
Patents Secured to Protect Inventions

Royal E. Burnham

Patent Attorney

Continental Trust Bldg.,
Washington, D. C.

TRADE MARKS

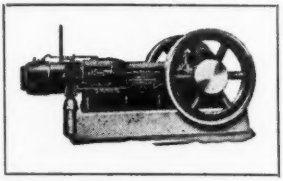


THOMAS HOISTS

Thomas Hoists are responsible for the records established by the big producers of sand, gravel and stone and are made in single and two-speed types, either steam or electric. Let us discuss your hoist problems with you.

THOMAS ELEVATOR COMPANY
21 South Hoyne Avenue CHICAGO

Buckeye Oil Engines Are Favorites

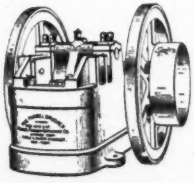


Single and two cylinder 55 to 260 H. P.
Horizontal accessible design with adjustable cross-head.
Cost least for repairs.
Burns low grade fuel.
One gallon lubricating oil operates 90 h. p. for 33 hours.
Write for catalogue.

THE BUCKEYE MACHINE COMPANY **Lima, Ohio**

"FARREL" CRUSHERS

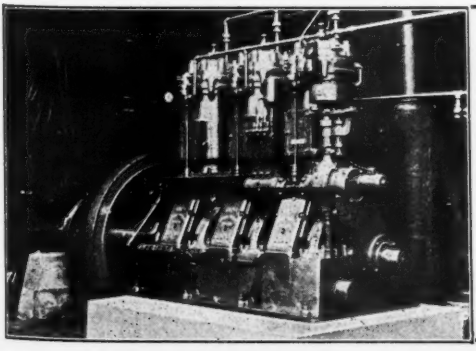
—World Famous—



Thousands in use on the hardest rock. Built in all sizes, 6″x3″ to 60″x48″. Complete rock crushing plants designed and equipped, also sand and gravel, washing and screening plants.

Send for latest bulletin E.

Earle C. Bacon, Inc., Engineers, 26 Cortlandt St., New York



TIPS OIL ENGINES burn low grade fuels. Solid Injection. 40—165 H.P. Sizes suitable for operating dragline excavators, hydraulic dredges and all stationary work. Variable speed, 100% water-cooled heads, no torches, Chrome-Vanadium crankshafts.

Write for Bulletin J-2

TIPS ENGINE WORKS
AUSTIN, TEXAS
Agents in all principal cities

Does 14 Inches Mean Anything to You?

Recently in a test conducted against several prominent hammer drills, the Wood Hammer Drill finished a 10 foot hole 14 inches ahead of the nearest competitor.

The rapid hard hitting blow, so characteristic of this drill, is obtained through a new principle embodied in our drills. The air operating the piston escapes instantly after the piston has completed its stroke, and does impede the rapid return of the piston by escaping where it was admitted. This we believe, and so it has proven, greatly improves the operation of our drill.

Let us tell you more about it.

WOOD DRILL WORKS, 30-36 Dale Ave., Paterson, N. J.

Makers of Hammer Drills and Piston Drills

Crushing and Grinding

Material Handling

Old Equipment Modernized

Properties Examined

C. H. SONNTAG

Engineer

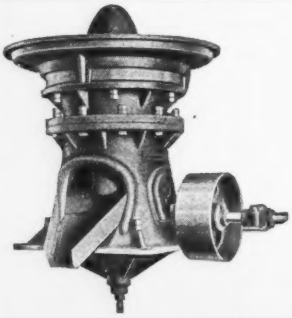
Cape Girardeau, Mo.

Portland Cement Plants

Electric Power Transmission

Power Plants

Waste Heat Boilers



AUSTIN
Gyratory Crushers

Portable and Stationary Plants

Capacities, 5 to 300 tons per hour

Catalog 29Q tells the whole story. Write for your copy today.

AUSTIN MANUFACTURING CO.

NEW YORK CHICAGO SAN FRANCISCO

McGANN MANUFACTURING COMPANY, INC.

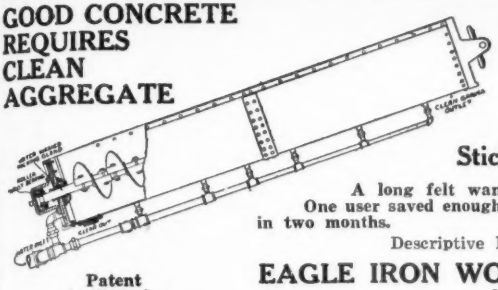
Engineers and Manufacturers

CHICAGO YORK, PA. NEW YORK

THE SCHULTHESS HYDRATOR— Built in all sizes to suit condition—Takes lime direct from the Kiln without crushing—lowest possible power required, about one-third the amount used by other Hydrators—Entire elimination of dust problem. *Put your Lime Problems up to us.*

YORK Kiln | SCHULTHESS Hydrators | YORK Double Shell Dryers

GOOD CONCRETE
REQUIRES
CLEAN
AGGREGATE



Patent
Applied for

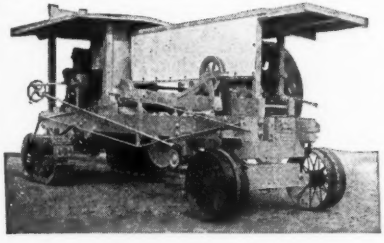
The EAGLE WASHER

Removes Mud Balls, Sticks, Coal and Shale.

A long felt want that actually does the business. One user saved enough to pay for the cost of this washer in two months.

Descriptive Bulletin now ready.

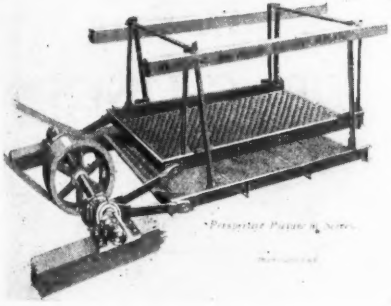
EAGLE IRON WORKS, Des Moines, Iowa
DEPT. P



The "CLIPPER"

late improved Blast Hole Drill. The "CLIPPER" predominates, has stood the test, and is approved by critics. Furnished also in the round wheel.

(Established 1842)
THE LOOMIS MACHINE CO. **15 Market St., Tiffin, Ohio**



SEAVERNS'
BALANCED
SHAKING SCREEN

Produces Clean Uniform Size Stone

Built for Those Wanting the Best

Made By **James B. Seaverns Co.**
Chicago
Send for "Dope"

FLORY BUILT HOISTS

are preferred because they are honestly built to do hard, continuous work efficiently and economically. Flory cableways are unexcelled for dependability. Write for catalog.

S. FLORY MFG. CO., Bangor, Penna.

SALEM
Genuine

Elevator Buckets

Since 1880, when Salem Buckets were awarded First Premium for superiority, no other make of bucket has approached the Salem in quality, long wear and unusual service. It is made in many different sizes and gauges of steel ranging from 24 gauge to 6 gauge, and is adaptable for handling materials of practically any size, shape or weight.

Our ability to furnish special buckets made up in accordance with your specifications enables us to offer excellent service and prompt delivery.

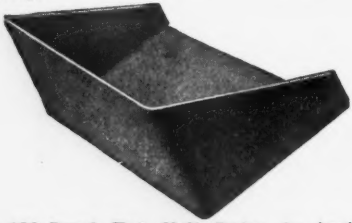


Fig. 132 Round Heel Shelf Bucket for handling damp materials which will not discharge rapidly from other styles of buckets.

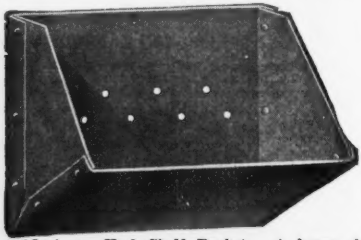


Fig. 133 Acute Heel Shelf Bucket. A heavy duty bucket, especially adapted for handling coad, stone, cement, ores, etc. May be attached to either chain or belt.

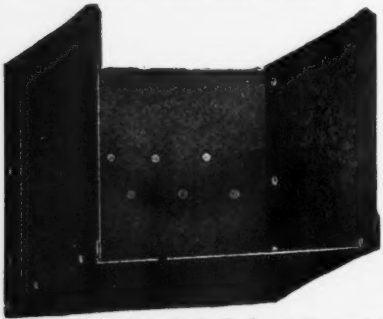


Fig. 736 Acute Heel Shelf Bucket with straight ends.

Write for Catalog 3625

MULLINS BODY CORP.

Successor to
W. J. CLARK CO.

106 Mill St., Salem, Ohio

FOR
DRAG LINES
POWER SHOVELS
DERRICKS

AMERICAN
STEEL & WIRE
COMPANY

Chicago New York

DEPENDABLE "DOMESTIC" POWER UNITS

You need a good pump at your plant

A "DOMESTIC" PUMP will remove all the water that accumulates around the quarry. It makes no difference if it contains mud, sludge, silt, clay or what-not,—a "DOMESTIC" Pump will handle it.

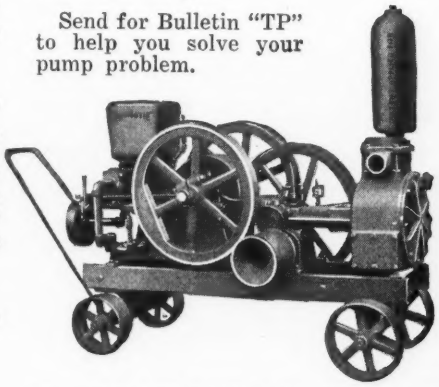
You should have a "DOMESTIC" because it has large capacity and discharges through long pipe or hose line to disposal point and makes no slop or odour. You need one also for your fresh water supply. "DOMESTIC" Double Acting Force Trench Pumps have large capacity and minimum weight.

Send for Bulletin "TP" to help you solve your pump problem.

Domestic Engine & Pump Co.

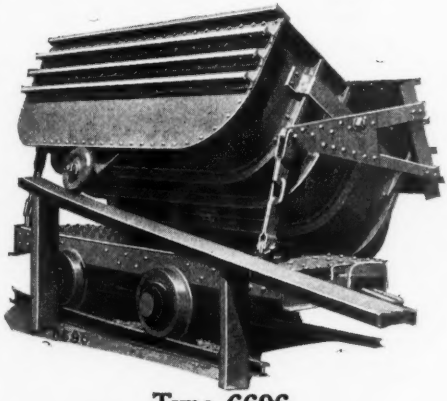
Manufacturers

SHIPPENSBURG, PENNA.



"Domestic" 4-TF Double Acting Force Trench Pump Unit

EASTON QUARRY CARS



Type 6696

Bulletin 21 shows other types of quarry cars. "Quarry Car Practice" published every now and then

Science

Science is knowledge gained by systematic observation. Therefore science should be applied to the building of quarry cars.

EASTON CAR & CONSTRUCTION CO.

Easton, Pa., and Kansas City, Mo.

New York, N. Y. Pittsburgh, Pa.
Richmond, Va. Chicago, Ill.
Philadelphia, Pa. San Francisco, Cal

EASTON CARS

FOR EVERY PIT MINE & QUARRY

Quarry face 1,600 feet long and 50 feet high being broken up by means of explosives detonated with Cordeau-Bickford

For one or for two hundred drill holes, use the safe, sure, and efficient detonating agent, Cordeau-Bickford. Even though you have no power line, you can still shoot any number of holes you desire by using Cordeau-Bickford. Write for booklet today.

The Ensign-Bickford Company

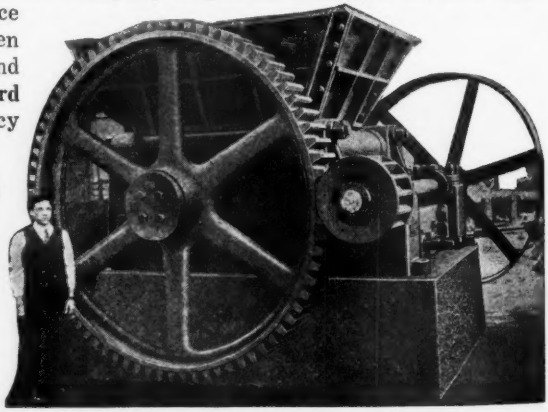
Original Manufacturers of Safety Fuse

Established 1836

SIMSBURY, CONNECTICUT

The STANDARD OF CRUSHERS

EVERYWHERE operators are comparing other crushers with the McLanahan-Stone Single Roll Crusher. There must be some reason for this comparison. The McLanahan-Stone Machine Company originated and built the first Single Roll Crusher in 1894. Since that date, they have been a continued success and have achieved a standard through merited efficiency and economical service.



OTHER McLANAHAN EQUIPMENT

McLanahan Screens, Washers, Elevators and Special Machinery.

All of our equipment conforms to the high standard of our Single Roll Crushers.

McLANAHAN-STONE MACHINE CO.

HOLLIDAYSBURG, PA.

For Quarrymen Who Want to Know More About Drilling

A NEW 120-page edition of our book "Big Blast Hole Drills" is ready.

Half of this book consists of information on the drilling qualities of different rocks, methods of operation and cost data on drilling and blasting.

The balance of the book describes in detail the three sizes of Cyclone Big Blast Hole Drills, one of which will handle practically any quarry's drilling.

The Sanderson-Cyclone Drill Co.

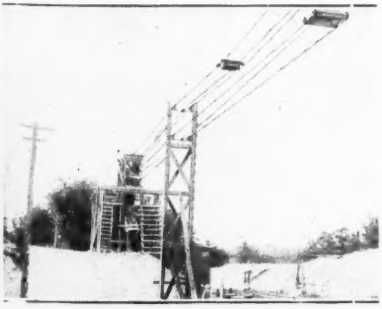
Orrville, Ohio

EASTERN AND EXPORT OFFICE:
30 CHURCH ST., NEW YORK

"PUT IT OVER"

With an

AUTOMATIC AERIAL TRAMWAY



A simple and inexpensive unit, safe and dependable, operation regardless of weather and a

ONE MAN JOB

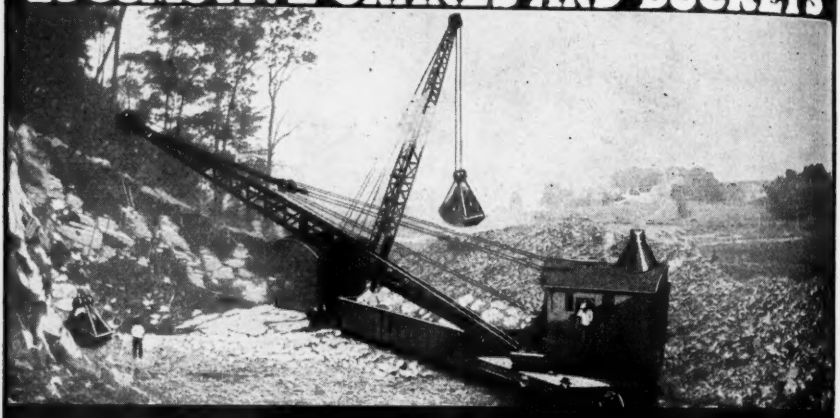
Let our engineers help you with your problem.

INTERSTATE EQUIPMENT CORP.

25 Church St. NEW YORK CITY

BROWNING

LOCOMOTIVE CRANES AND BUCKETS



The Browning Crane Company

16226 Waterloo Rd., Cleveland, O.

Producing GRUENDLER **Pulverizers** *Agricultural Lime—*

are now producing Agricultural Lime dust at the lowest cost per ton, and of the most uniform quality. These pulverizers are made in stationary and portable types, with capacities of from 1 ton per hour to 15 tons per hour.

The usual GREUNDLER performance is found in these machines and the usual satisfaction. This is the farmers' fertilizing season. Write for our interesting bulletin, "Folks & Fields Need Lime," which tells why lime is needed on the farms. Write

Write for list of users

GRUENDLER PATENT CRUSHER & PULVERIZER *Company*

FIRST & FRANKLIN ST. LOUIS, MO.

ELEVATORS, SCREENS
Conveyors & Equipment

WHATEVER your needs in mechanical handling and screening equipment for sand-and-gravel or quarry plant, you will profit by getting in touch with this Company. We carry an extensive stock and shop facilities for turning out your needed equipment in short order.

In thinking of a new or enlarged plant you will want our Catalog 623 for ready reference. **Ask for it.**

Manufacturer of
THE GEORGE
-Truck and-
Wagon Loaders
Portable Belt
Conveyors

HAISS

Established 1892
MFG. CO. INC
Clam Shell
-Buckets-
Marl Handling
Equipment.

142nd St. and Rider Ave., New York, N. Y.
Representatives Throughout the World
Cable Address "Coalhoist" New York—"Western Union 5 Letter Edition" Code

SPEARWELL MOGUL LOADER
A Strictly One Man Machine
CAPACITY 1½ to 2½ CU. YDS. PER MINUTE
Weight 14,000 lbs.

Equipped with positive and efficient excavating, feeding and cleanup device.

Clears path 8 feet wide.

Guaranteed to excavate harder material and to clean up better than any loader of its kind on the market, bar none.

40 H.P. 4 cyl. Heavy Duty Buda Motor.

Positive self-cleaning track. 1500 square inches of bearing surface, less than 10 lbs. per square inch.

Digging and crowding speeds 4 and 20 ft. per minute. Traveling speeds ½ to 2½ miles per hour.

Digging position quickly and easily adjusted and absolutely maintained by special grade control shoe.

Swivel chute controlled from operator's platform, permits loading in any position.

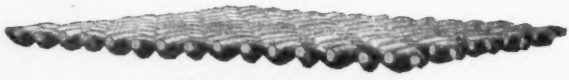
Write for literature and prices on Spearwell Loaders—a size for every need.

SPEARS-WELLS MACHINERY CO.
Manufacturers of SPEARWELL CONSTRUCTION EQUIPMENT
Oakland, California

TRADE ROL-MAN MARK

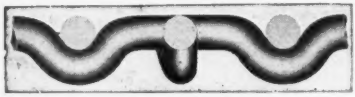
WOVEN MANGANESE STEEL SCREENS

Highest Efficiency—Greatest Economy—Longest Life



Note Face of Screen is flat

Both rods crimped preventing displacement.



Note closed double locked mesh.

Enlarged section through centre of mesh.

The Crimping is all on one side of screen. Makes wearing side smooth and flat. Will handle 50 to 100% more material than perforated plate.

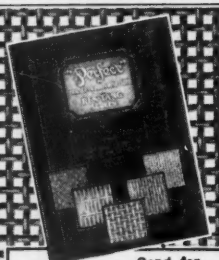
Made in all shapes and sizes—Flat, Rolled to Circles or Cones.
To Fit ANY Revolving, Shaking or Vibrating Screen.

Manganese Steel Forge Co.

Richmond & Erie Ave., PHILADELPHIA, PA.

Manufacturers of "ROL-MAN" Rolled and Forged Manganese Products

DOUBLE CRIMPED WIRE CLOTH



"Perfect" Service

1 Most COMPLETE wire cloth SERVICE
2 Most ACCESSIBLE wire cloth SERVICE
3 Most RELIABLE wire cloth SERVICE
4 Most ADAPTABLE wire cloth SERVICE
5 Most ECONOMICAL wire cloth SERVICE

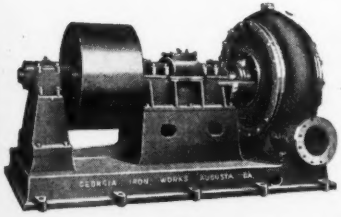
Send for Catalogue No. 47-E
It lists a thousand screens.

The LUDLOW-SAYLOR WIRE COMPANY St. Louis
610 South Newstead Avenue

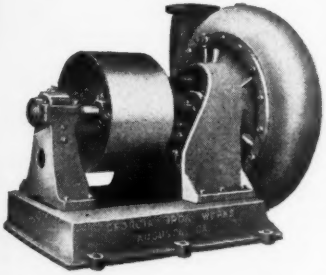
Dredging $1,000.00 in Gold per Day with an 80 H.P. Venn Severin Oil Engine at Nome, Alaska

The owners of the Dry Creek Dredging Company have never had any trouble with the Venn Severin oil engine that is giving them twenty-four hour service daily. No repairs—that's the proof of the pudding. Absolutely reliable—no wear, no carbon. Why? Because in a Venn Severin oil engine the combustion is complete and the cylinder pressures are low. The type D Venn Severin oil engine is the better engine for your dredging requirements. Sizes range from 15 to 250 H.P. Write for circular.

VENN SEVERIN MACHINE COMPANY
1317 WEST NORTH AVENUE, CHICAGO, ILLINOIS



Heavy duty belt driven sand and dredging pump built in 8", 10", and 12" sizes.



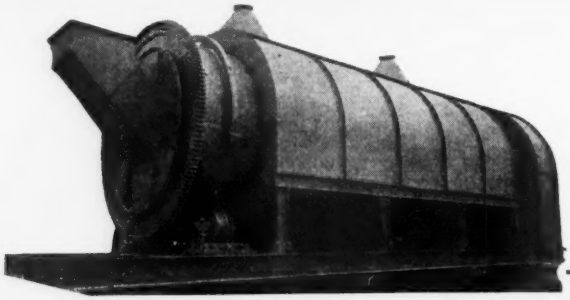
Overhanging type belt driven sand and dredging pump. Built in 6" and 8" sizes.

SAND PUMPS

The accompanying cuts show two very popular types of belt driven units. These pumps are also built with bases for direct connection to motor.

Send for illustrated catalog showing our complete line of this equipment including flanged pipe fittings and hydraulic guns.

GEORGIA IRON WORKS
AUGUSTA, GA.
Established 1891



A PROFITABLE INVESTMENT

The Continuous Cement Bag Cleaner will pay its own purchase price after being in operation a short while. It not only thoroughly cleans the bags, but reclaims approximately one pound of cement per bag. The process, besides being economical, simple, and labor saving in its performance, will efficiently clean and reclaim cement from 2,000 to 10,000 bags per hour.

A number of the largest and most modern mills in the country are now using this Bag Cleaner with the most gratifying results.

NAZARETH FOUNDRY AND MACHINE COMPANY

Works: Nazareth, Pa. **New York: 106 Front St.**

SAND **ROCK**

DRYERS

"BUCKEYE SPECIAL"

Semi-Portable — Compact — Self-Contained
Oil Fired — Rugged Construction — Heavy Duty Service

No elaborate foundations required to erect this Dryer. We ship it to you assembled complete. Set it on simple concrete piers, and it is ready to operate.

Built in Six Standard Sizes

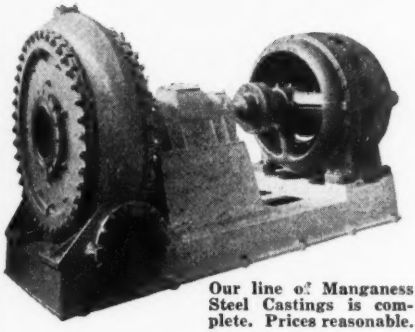
5 tons per hour to 50 tons per hour capacity. Furnished with or without elevating machinery. Write us for full information and prices.

The BUCKEYE DRYER COMPANY

1351 Railway Exchange Bldg. **CHICAGO, ILL.**

Manganese Steel Castings

The Right Pump for Sand and Gravel Producers—



Our line of Manganess Steel Castings is complete. Prices reasonable.

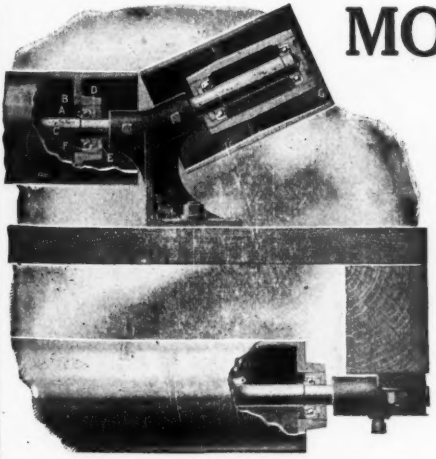
DIAMOND

This is the result of combining Right Principles of Construction with Right Materials. Diamond Pumps are made of manganese steel, the toughest and most durable metal made. Many operators of sand and gravel pits can testify to the fact that the Diamond is a strong, enduring and serviceable pump.

Diamond Pumps are built in all sizes, with belt drive or direct connected motor drive. Get satisfaction by learning all about the Diamond from W. H. K. Bennett.

W. H. K. BENNETT
20 E. Jackson Blvd., Chicago

PETTIBONE MULLIKEN CO.
CHICAGO, ILL.



MORE POWER

To You In Your CONVEYOR SERVICE

This apt phrase has a real significance to you and to the Conweigh Ball Bearing Troughing and Return Idler.

You have grappled with this knotty problem many times, only to come out unsatisfied by your experiment with the wrong kind of conveyor. Here are the questions that trouble and perplex:

- How to get more out of every unit of power.
- How to reduce friction and realstance.
- How to increase conveyor volume.
- How to get smooth and efficient service.

Conweigh Ball Bearing Troughing and Return Idlers perform these functions perfectly. Through their correct design and durable, hardened steel construction, well reinforced and easy to lubricate, the usual faults are eliminated.

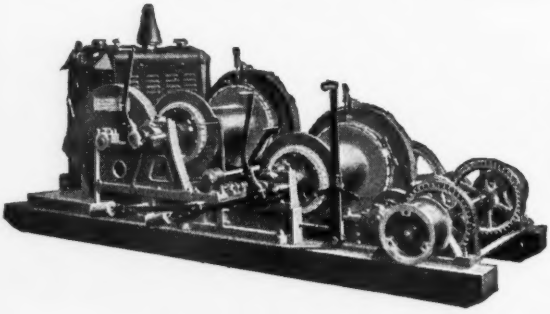
Better clean up this costly conveyor problem, once and for all. Let us give you full, detailed information on the subject.

THE CONVEYING WEIGHER COMPANY
90 West Street ENGINEER & CONTRACTOR New York

LIDGERWOOD HOISTS

Steam—Electric—Gasoline

Built in Types for Every Contractor's Service



They do their work to your Profit

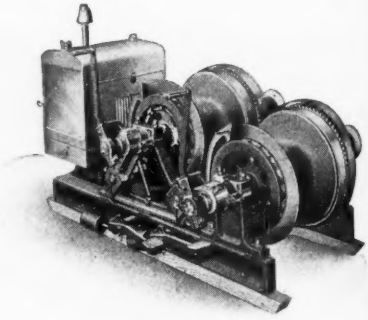
LIDGERWOOD MFG. CO., 96 Liberty St., New York

Chicago; Pittsburgh; Philadelphia; Detroit; Los Angeles; Seattle; Tacoma; Portland, Ore.; Brown-Marx Bldg., Birmingham, Ala. **Sales Agents:** Norman B. Livermore, San Francisco; Woodward, Wight & Co., New Orleans, La.; John D. Westbrook, Inc., Norfolk, Va.; Cameron & Barkley Co., Jacksonville, Miami, Tampa, Fla.; Canadian Allis-Chalmers, Ltd., Toronto. **Foreign Offices:** Sao Paulo, Brazil; Rio de Janeiro, Brazil; London, Eng.

O. & S. Hoists

Our line of Hoists covers Steam, Electric and Gasoline in Single, Double or Triple Drum and with or without Boom Swinging Attachment.

Write for descriptive Bulletins.



ORR & SEMBOWER, Inc.

READING, PENNA.

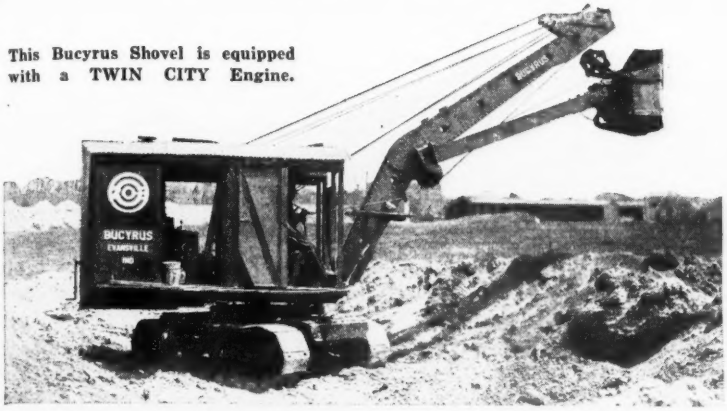
Established 1885

50 Church St.
New York City

208 N. Clinton St.
Chicago, Illinois

TWIN CITY ENGINES

This Bucyrus Shovel is equipped with a TWIN CITY Engine.



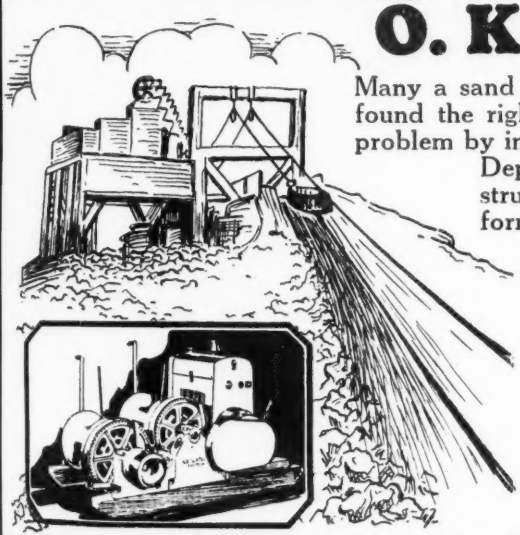
Other Twin City users include: Austin Machinery Corp., Baldwin Locomotive Works, Buckeye Traction Ditcher Co., The Parsons Co., Northwest Engineering Co., The Harnischfeger Corp., Pennsylvania Pump & Compressor Co., Star Drilling Machine Co., Washington Iron Works, Willamette Iron & Steel Works, Etc. Specify Twin City Engines on **your** equipment. Sizes 35 to 140 H.P. Write for literature.

TWIN CITY COMPANY, Minneapolis, Minn.

Heavy Duty Engine Manufacturers since 1903

"BUILT TO DO THE WORK"

Solve Your Hoisting Problem With an O. K. HOIST!



Many a sand and gravel operator has found the right answer to his hoisting problem by installing an O. K. Hoist.

Dependability, sturdy construction and consistent performance, light weight and easy portability, are O. K. qualities, and the qualities you want in your hoist. The O.K. HOIST stands up under hard service.

Easily adjusted or repaired. Write for full information.

O. K. CLUTCH & MACHINERY CO.

BOX 305, COLUMBIA, PA.

BUCKETS

The Caldwell Seamless Steel Bucket is a one-piece, pressed steel bucket, without laps, seams or rivets, and is superior to buckets of the folded type thru its rugged construction alone. If you need elevating, conveying or transmission machinery promptly, address Caldwell, or nearest Link-Belt office.

H. W. CALDWELL & SON CO.

LINK-BELT COMPANY, OWNER

Chicago, 1700 S. Western Ave.; New York, 2676 Woolworth Bldg.; Dallas, 810 Main St.

CALDWELL

Wash and Classify Your Materials

The PERFECT CLASSIFIER is a standard machine and a necessity in everyplant.

The demand for road and building material grows steadily larger every year. With this growth the demand for cleaner, higher grade materials grows also.

The producer who wants his share of business and profits must therefore meet requirements. A **Perfect Classifier** is a necessity. It removes all foreign matter from sand, gravel, limestone and other materials, and insures better prices. Send for full information.

PERFECT CLASSIFIER COMPANY

Manufacturers of ORE CLASSIFIER MACHINERY

105 First Ave., South NASHVILLE, TENN.

Replacement time came, but not a sign of wear

The belts on this sand and gravel conveyor used to have an average life of eight months. Sometimes they had been taken up as many as eight times before they were replaced. When the owners installed a "U.S." Conveyor Belt they expected to be in the market again in another eight months. Instead, they reported at the end of that time that it showed not a sign of wear, and that it had never once been taken up.

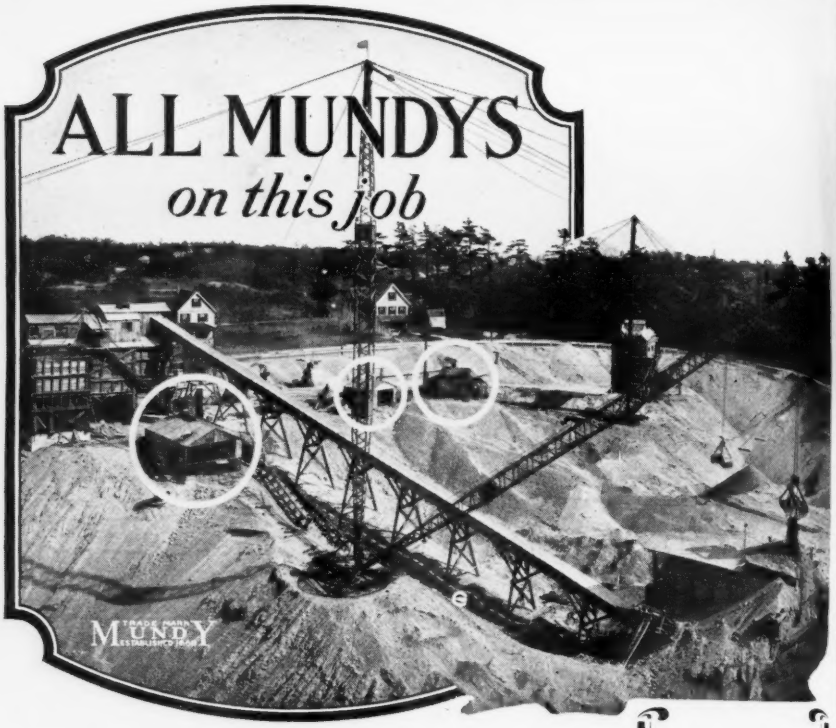
This conveyor operates 12 hours daily, at a speed of 200 F. P. M. over 24″ pulleys, and handles 1500 tons per day. The belt is a "U.S." Security Conveyor Belt 375 ft. long, 24″ by 6 ply, ⅛″ top cover, $\frac{1}{16}$″ bottom cover, 28 oz. duck body.

United States Rubber Company

1790 Broadway New York City

Trade Mark

Branches in every industrial center



ONE of the largest guy derricks in New England is being operated continuously day and night by Mundy Hoists. A 10"x13" three drum hoist moves 1000 yards of sand and gravel in eight hours with a two yard bucket, taking three yards at a bite. It requires only 45 seconds to make a round trip through a half circle swing.

Mundy Hoists are built with Asbestall non-burn frictions to withstand the great abrasive action of the sand and gravel encountered in this kind of work.

A new 40 page booklet, just off the press, describing Mundy gasoline hoists is now ready. You can get your copy by dropping a card.

Plant of the Riverside Sand and Gravel Co., Newton Lower Falls, Massachusetts.

Chief Engineer De Lorenzo says:

"These Hoists are giving us the best of service under adverse conditions with practically no repair expense."

J. S. Mundy Hoisting Engine Company
Newark, New Jersey, U. S. A.

New York Sales and Export Office, 30 Church St.
Agents in principal cities

MUNDY HOISTS

THE HOIST WITH THE ASBESTALL FRICTIONS